U.S. ATOMIC ENERGY COMMISSION
REGULATOR[illegible]MAIL AND
RECORDS [illegible]CTION
WASHINGTON, D.C. 20545

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. ATOMIC ENERGY COMMISSION

2743 MN
0516

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

Attn: Mr. C. S. Hollander

HQ-46
(9-64)

UNITED STATES ATOMIC ENERGY COMMISSION
REGULATORY MAIL AND RECORDS SECTION

Your [X] letter, [ ] application, dated January 27, 1970

submitting supplemental information relevant to the termination of your Source Material License #376 including enclosures thereto is acknowledged and has been assigned:

DOCKET No. 40-5063 or CONTROL No. _____

Please refer to the above number(s) in future correspondence.

Date Received: January 29, 1970

This is an acknowledgment form only.
It is not a reply to your communication.

9900
Ser 30 - 0516
9 FEB 1970

From: Commander, Naval Electronic Systems Command
To: Commander, Hunters Point Naval Shipyard
NRDL Disestablishment Group =Attn: Mr. R. C. Tartaul

Subj: AEC Source Material License No. SMB-378

Ref: (a) FONECON between Mr. A. Kielwasser, NRDL Disestablishment Group, and Mr. Mahaffey, NAVELEXSYSCOMHQ on 9 FEB 1970

Encl: (1) AEC letter DML:DFH 40-5063 of 4 FEB 1970

1. Enclosure (1) covers the termination of subject license and is being forwarded in accordance with the telephone conversation, reference (a).

M. G. WILLIAMS
By direction

Copy to:
BUMED(Code 74)

051 reading file

MAHAFFEY/mitchell
61457 - 2/9/70
Serial 0206-113-70

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

FEB 4 1970

DML:DFH
40-5063

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

Attention: Mr. C. S. Hollander
9900
Ser 17-0516

Gentlemen:

As requested in your letter dated November 26, 1969, as supplemented January 27, 1970, AEC Source Material License No. SMB-376 is hereby terminated.

FOR THE ATOMIC ENERGY COMMISSION

Don F. Harmon

Don F. Harmon
Source and Special Nuclear
Materials Branch
Division of Materials Licensing

ACTION:
INFO:
FILE NO:
CON. NO: 0276 113-70

2-6-70

Telcon from Al. Kulwaccer: [415-641-2759 (H)].

1. Mr. Tartel - Officer-in-charge - USNRDL Decontablishment Group at Shipyard.

2. Mr. Fish, AEC Div. of Compliance, Berkeley, Calif. sent a message to AEC Office in Washington D.C. confirming survey made by USNRDL Decontablishment Group that Bldg. is acceptable for unlimited use & license may be terminated. This will permit termination of the Source Material License SMB-376 & Byproduct Material License # 04-13488-01. One license still remains SNM-35. The AEC Forms, (338) & (101) are in preparation & a ltr. requesting termination of the SNM-35 will be forwarded to AEC via NAVELEX in a week.

3.

1-29-70

Telcon From A. Kilwassen – Ext. 2478

1. To-morrow, 30 Jan. – last day.
NRDL Disestablishment Group be in charge of –
Robt. C. Jartaul } Info on paper having
Dir. of Mgmnt Eng. } need for personnel reaction
Code H-140, Bldg. 101, Rm-1303 (Ext. 2171 or 2172

2. All records will be left with Mr. Jartaul.

3. Will get a ltr. out to-day to terminate SNM- license.
Preparing AEC-388 Forms (x fering material).
Have discussed x fers / mtl. with:
AEC Materials Licensing Office
Mr. H. J. McAlduff, Jr.
Oak Ridge Op. Office
P.O. Box E, Oak Ridge, Tenn. 37830
Tel: Area Code 615 – 483-8611, Ext. 34566
Will receive copies of x fers for mtl.

4. On the AEC Byproduct ------ 01 license
Ray Fish, from AEC Office Berkeley. Will be in
Lab to-day for final check-up. Upon completion
will send a msge to N. Bassin, AEC, probably the
P.M. and upon receipt N. Bassin will issue
an amendment to terminate "01 license.

5. Al Kielwasser home address & phone #

163 Park St.
San Francisco, Calif. 94110
Area Code 415 - ATwood - 20217
(2/3 distance toward Daly City - Turn Off Mission Street).

9900
Ser 17 - 0516
27 JAN 1970

FIRST ENDORSEMENT ON NAVSHIPYD SFRAN BAY LETTER N730-15 8071 OF 21 JAN 1970

From: Commander, Naval Electronic Systems Command
To: Chief
Source and Special Nuclear Material Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: AEC Source Material License No. SMB-376

1. Basic letter with enclosure contains requested supplemental information relevant to the termination of subject license.

2. The material has been reviewed and includes the disposition of source material and decontamination procedures used in connection with the disestablishment of NRDL (Naval Radiological Defense Laboratory) at the Shipyard.

04/15/1 - NRMO

C. S. HOLLANDER
By direction

Copy to:
BUMED(Code 74)
NAVSHIPYD, SFRAN BAY

051 reading file

MAHAFFEY/mitchell
61457 - 1/27/70
Serial 0126-053-70

SAN FRANCISCO BAY NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:
R730-76
8071

Recd: 1/26/70 & fwded as 1st. end. to AEC ltr Ser. 05/6 — 26 — Jan. 1970.

JAN 21 1970

From: Commander, San Francisco Bay Naval Shipyard
To: Chief, Source and Special Nuclear Material Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545
Via: Commander, Naval Electronics Systems Command (Code 05163)

Subj: AEC Source Material License No. SMB-376

Ref: (a) SFBNS ltr Ser No. R200-13 8071 of 20 Nov 1969, w/1st End.
(b) NAVELECSYSCOM ltr 9900 Ser No. 5-0516 of 7 Jan 1970, w/encl AEC ltr DML:DFH 40-5063 of 23 Dec 1969

Encl: (1) San Francisco Bay Naval Shipyard Report, "Health Physics Activities in Connection with the Disestablishment of NRDL" of 31 Dec 1969.

1. Reference (a) requested that AEC Source Material License No. SMB-376 be terminated. Enclosure (1) of reference (b) requested a report indicating that radioactivity and contamination limits have been met.

2. All source material held under subject license was transferred to other AEC or State licensed activities. Stanford University, Stanford, Calif.; Naval Ordnance Laboratory, White Oak, Silver Spring, Maryland; Lawrence Radiation Laboratory, University of California, Berkeley, Calif.; Los Alamos Scientific Laboratory, Los Alamos, New Mexico; Gulf General Atomic, Inc., San Diego, Calif.; Union Carbide Corp. Y-12 Plant, Oak Ridge, Tenn. and to Nuclear Engineering Co., Inc. Walnut Creek, Calif. for waste disposal.

3. Source material held under SMB-376 was contained entirely in NRDL Building 815. Enclosure (1) covers decontamination procedures in connection with the disestablishment of NRDL. Radioactive surveys and swipes were made on all floors. Wherever contaminated areas were found, the radioactive components were either decontaminated or removed and disposed of. Upon completion of the decontamination effort no fixed alpha radioactivity could be detected anywhere in the building. The maximum level of detectable fixed beta-gamma activity was less than twice background (0.04 millirad per hr). Similarly, there was no measurable amount of removable alpha or beta-gamma activity. None of the levels listed in the enclosure of reference (b) was exceeded.

ACTION: 0516 E
INFO: 9900

0126 053-70

M.M. EDWARDS, JR
Officer-in-Charge,
NRDL Disestablishment Group
By direction.

Copy to: (w/o encl)
BUMED (Code 74)

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

DEC 2 3 1969

DML:DFH
40-5063

ACTION: 0516
INFO: 6
9673

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

Attention: Mr. M. G. Williams

1230-076-09

Gentlemen:

In reply to your request dated November 26, 1969 (9900 Ser 322 - 0516), for termination of AEC Source Material License No. SMB-376, we will need a report indicating that the enclosed contamination limits have been met for areas and equipment used in conjunction with the material authorized under License No. SMB-376.

Please let me know if you have any questions concerning the above.

Sincerely,

Don F. Harmon

Don F. Harmon
Source and Special Nuclear
Materials Branch
Division of Materials Licensing

Enclosure:
"Radioactivity Limits . . ."

RADIOACTIVITY LIMITS FOR UNRESTRICTED RELEASE OF FACILITIES AND EQUIPMENT CONTAMINATED WITH SOURCE AND/OR SPECIAL NUCLEAR MATERIAL

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma survey meter through a tissue equivalent absorber of not more than seven milligrams per square centimeter should not exceed one millirad per hour.

   (b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millirad per hour.

5. The contamination limits for abandonment of facilities involving U-233 or plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

NOTES: A. A reasonable effort should be made to minimize the contamination present.

B. Surfaces of premises, equipment or scrap likely to be contaminated, and of such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the levels specified above.

C. Premises, equipment or scrap having contaminated surfaces which have been covered by painting, metal plating or other covering material should be presumed to be contaminated in excess of the levels specified above, unless it can be established that the contamination was below the above levels prior to applying the covering.

For Dr. & NM

9900
Ser 5 - 0516
7 JAN 1970

From: Commander, Naval Electronic Systems Command
To: Commander, San Francisco Bay Naval Shipyard
NRDL Disestablishment Group
San Francisco, California 94135
Attention Mr. E. ~~Toschlin~~ Tochilin

Subj: AEC Source Material License No. SMB-376

Ref: FONECON between Mr. Mahaffey, NAVELEX HQ and Mr. Tochilin, NRDL Disestablishment Group on 6 JAN 1970

Encl: (1) AEC letter DML:DFH, 40-5063 of 23 DEC 1969 with Attachment

1. Enclosure (1) covers a request from the Atomic Energy Commission relevant to a report indicating that radioactivity limits for unrestricted release of facilities and equipment contaminated with source material have been met prior to the termination of subject license.

2. Details of areas covered and a report which is in preparation by the Disestablishment Group were discussed during the telephone conversation, reference (a).

M. G. WILLIAMS
By direction

Copy to:
BUMED(Code 74)

MAHAFFEY/mitchell
61457 - 1/6/70
Serial 1230-076-69

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

DEC 23 1969

DML:DFH
40-5063

ACTION: 0516

INFO: 6

9613

1230-076-119

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

Attention: Mr. M. G. Williams

Gentlemen:

In reply to your request dated November 26, 1969 (9900 Ser 322 - 0516), for termination of AEC Source Material License No. SMB-376, we will need a report indicating that the enclosed contamination limits have been met for areas and equipment used in conjunction with the material authorized under License No. SMB-376.

Please let me know if you have any questions concerning the above.

Sincerely,

Don F. Harmon

Don F. Harmon
Source and Special Nuclear
Materials Branch
Division of Materials Licensing

Enclosure:
"Radioactivity Limits . . ."

RADIOACTIVITY LIMITS FOR UNRESTRICTED RELEASE OF FACILITIES AND EQUIPMENT CONTAMINATED WITH SOURCE AND/OR SPECIAL NUCLEAR MATERIAL

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma survey meter through a tissue equivalent absorber of not more than seven milligrams per square centimeter should not exceed one millirad per hour.

   (b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millirad per hour.

5. The contamination limits for abandonment of facilities involving U-233 or plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

NOTES: A. A reasonable effort should be made to minimize the contamination present.

B. Surfaces of premises, equipment or scrap likely to be contaminated, and of such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the levels specified above.

C. Premises, equipment or scrap having contaminated surfaces which have been covered by painting, metal plating or other covering material should be presumed to be contaminated in excess of the levels specified above, unless it can be established that the contamination was below the above levels prior to applying the covering.

9900
Ser 322 - 0516
NOV 26 1969

FIRST ENDORSEMENT ON NAVSHIPYD SFRAN BAY LETTER SERIAL R200-13 8071 OF 20 NOV 1969

From: Commander, Naval Electronic Systems Command
To: Chief
Source and Special Nuclear Materials Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

12/25/11 - MMM

Subj: AEC Source Material License No. SMB-376

Ref: (a) FONECON between Mr. Mahaffey, NAVELEX HQ and Mr. L. Miller, NRDL Disestablishment Group, NAVSHIPYD, SFRAN BAY on 25 NOV 1969

1. Basic letter contains a request to terminate subject license.

2. This material has been reviewed and details of the transfer and/or disposal as radioactive waste of the natural Uranium, uranium depleted ^{235}U Isotope, and Thorium authorized under license SMB-376 were discussed during the telephone conversation, reference (a). A report on the disposition of the material is in preparation by the NRDL Disestablishment Group at the Shipyard.

Copy to:
BUMED(Code 74)
NRDL DISESTABLISHMENT Group
051 reading

M. G. WILLIAMS
By direction

MAHAFFEY/mitchell
61457 - 11/26/69
Serial 1124-112-69

SAN FRANCISCO BAY NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:
R200-13
8071

NOV 20 1969

Rec'd: 11/25/69

From: Commander, San Francisco Bay Naval Shipyard
To: Chief, Division of Material Licensing,
U.S. Atomic Energy Commission
Via: Commander, Naval Electronic Systems Command (ELEX 05163)

Subj: Termination of AEC Source Material License held by NRDL

1. Following the disestablishment of NRDL on 3 November 1969 all remaining functions were transferred to the NRDL Disestablishment Group, San Francisco Bay Naval Shipyard, San Francisco, California. Source Material License SMB-376 issued to NRDL on June 29, 1967 was retained in the transfer.

2. It is requested that the NRDL Source Material License SMB-376 be terminated at this time. All existing natural uranium and thorium sources have been transferred to other activities with the remainder disposed of as radioactive waste. There is no further need for such material at this activity.

M.M. EDWARDS, JR.
By direction.

3 Dec. 1969

Telcon From: Don Harmon, AEC, Ext. 7445

1. Recd. 1st End. on NAVSHIPYD SFRANBAY ltr. requesting termination SMB-376 (Source Mtl. Lic.) ow ltr. 9900 Ser 322-0516, of 26 Nov. 1969.
2. Prepared quick & routed to D. Harmon.
3. Had some specific questions: 1) clearance levels followed during release status?
2) has decontamination / area been completed?
4. Indicated I would call Shipyard & get on the word. Called & talked to Al Delwasser since L. Miller wasn't available. Stated these addtl. info would be put in ltr. finding report on disposition of material by NRDL / Decontamination Grp.
5. Mr. Harmon called back & said "send ltr."
6. Recd. card acknowledging receipt of ltr. requesting termination of Lic. #376 on 12/3/69

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

DML:DFH
70-35
40-5063

Orig. signed received from AEC on 10/11/68 & fwd'd by Stamp Form to USNRDL on 11 Oct. 1968

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

OCT 9 1968

Attention: Mr. M. G. Williams

Gentlemen:

Thank you for your letter dated September 30, 1968, notifying us of a change in the membership of the Radiological Safety Committee at the U. S. Naval Radiological Defense Laboratory. Please continue to keep us informed of changes in personnel who will have responsibility for licensed materials under AEC Source Material License No. SMB-376 and Special Nuclear Material License No. SNM-35.

Sincerely,

Don F. Harmon

Don F. Harmon
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

9900
Ser 313 - 0516

SEP 30 1968

From: Commander, Naval Electronic Systems Command
To: Chief
Source and Special Nuclear Materials Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: AEC Source Material License No. SMB-376 and AEC Special Nuclear Material License No. SNM-35

1. Basic letter with enclosures contain updated material relevant to the Radiological Safety Committee at the U. S. Naval Radiological Defense Laboratory.

2. A change in the membership of the Radiological Safety Committee has been necessary due to a recent change in staffing at the Laboratory. Members and qualifications of the Committee are covered in enclosures which are replacement sheets for supplemental material previously submitted with applications for renewal of subject licenses.

M. G. WILLIAMS
By direction

Copy to:
BUMED, Code 74
NRDL, SPRAN

MAHAFFEY/mitchell
61457 - 9/30/68
Serial 0927-109-68

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

IN REPLY REFER TO:
DML:RTW
70-35
40-5063

OCT 18 1967

Recd. 11/1/67

Department of the Navy
Naval Electronic Systems Command
Washington, D. C. 20360

Attention: Mr. C. S. Hollander
Your reference: ELEX-0516
9900
Ser 371

Gentlemen:

Thank you for your letter dated September 25, 1967, notifying us of a change in the membership of the Radiological Safety Committee at the U. S. Naval Radiological Defense Laboratory. We appreciate your keeping us informed of such changes in responsible personnel under Source Material License No. SMB-376 and Special Nuclear Material License No. SNM-35.

Sincerely yours,

Robert R. Layfield

Robert L. Layfield
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

ELEX-0516
9900
Ser 371
25 SEP 1967

FIRST ENDORSEMENT ON USNRDL LETTER 730-137 AK:kmm CC 19 SEP 1967

From: Commander, Naval Electronic Systems Command
To: Chief, Source and Special Nuclear Material Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: AEC Source Material License No. SUB-376 and AEC Special Nuclear Material License No. SNM-35

1. Basic letter with enclosures contain updated material relevant to the Radiological Safety Committee at the U. S. Naval Radiological Defense Laboratory.

2. A recent change in staffing at the Laboratory has made it necessary to make a change in the membership of the Radiological Safety Committee. Members and qualifications of the Committee are covered in enclosures which are replacement sheets for material previously submitted with applications for renewal of subject licenses.

Copy to:
BUMED(Code 74)
NRDL, SFRAN

C. S. HOLLANDER
By direction

MAHAFFEY/mitchell
61457 - 9/25/67
Serial 670922-0426

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:
730-137
AK:kmm

19 SEP 1967

Recd. 9/22/67 & fwded. by 1st End. ltr Ser 0516—371 of 25 Sept. 67

AIRMAIL

From: Commanding Officer and Director
To: Chief, Source and Special Nuclear Materials Branch, Division of Materials Licensing, U. S. Atomic Energy Commission, Washington, D. C. 20545
Via: Commander, Naval Electronic Systems Command, (Code 05163), Munitions Building, 18th & Constitution Avenues, Washington, D. C. 20390

Subj: Modification of U. S. Naval Radiological Defense Laboratory's (NRDL) Applications for Source Material License No. SMB-376 and Special Nuclear Material License No. SNM-35

Ref: (a) NRDL ltr 730-118 AK/kmm dtd 30 Jun 1967
(b) NRDL ltr 730-89 AK/jp dtd 29 Dec 1964

Encl: (1) Supplement 3 (Item 10) Radiological Safety Committee Members and Qualifications (two (2) copies)
(2) Pages 3 and 3a Radiological Safety Committee Members and Qualifications (two (2) copies)

1. As a result of a recent change in staffing at NRDL, it is necessary to make a change in the membership of the Radiological Safety Committee. Dr. M. I. Varon, CDR, MC, USN has been replaced by Dr. T. R. Birdwell, LCDR, MC, USN as an alternate chairman.

2. It is requested that enclosure (1) replace Supplement 3 (Item 10) (Page 3) of reference (a) and that enclosure (2) Pages 3 and 3a replace present pages 3 and 3a of reference (b).

T. R. BIRDWELL
By direction

Supplement 3 (Item 10)

Radiological Safety Committee Members and Qualifications

Dr. Edward R. Tompkins, Chairman

Chairman, Radiological Safety Committee, NRDL, November 1962 to date; Associate Scientific Director, NRDL, November 1961 to date; Scientific Liaison Officer, ONR, London, England, July 1960 -October 1961; Head, Chemical Technology Division, NRDL, December 1951-June 1960; Consultant, NRDL, five (5) months-1951; Consultant, U.C. Radiation Laboratory, Berkeley, California-16 months; Assistant Manager and Director of Research for Scientific Service, Inc., Berkeley, California-18 months; Radiochemist, AEC, Advisory Field Service, Oak Ridge, Tennessee-six (6) months; Supervisor, Chemistry Department, Clinton Laboratory, Oak Ridge, Tennessee-four (4) years; Research Chemist, Armour Research Foundation, Chicago, Illinois, one (1) year.

Albert L. Smith, Alternate Chairman

Head, Health Physics Division, NRDL, February 1962 to date; Head, Radiological Safety Branch, Health Physics Division, NRDL, July 1956-February 1962; Health Physicist, NRDL, October 1951-July 1956; Health Physicist, General Electric Corporation, Hanford Atomic Products Operation, January 1948-October 1951.

Dr. Thomas R. Birdwell, LCDR, MC, USN, Alternate Chairman

Head, Medical Department, NRDL, July 1967 to date. Research Pathologist, Biological and Medical Sciences Division, NRDL, 1966-1967; Pathology Resident, Department of Pathology, U.S. Naval Hospital, San Diego, California, 1962-1966; Internship, U.S. Naval Hospital, Camp Pendleton, California, 1961-1962; M.D., Tulane University Medical School, 1961.

Dr. Edward L. Alpen

Head, Biological and Medical Sciences Division, NRDL, April 1959 to date; Head, Biophysics Branch, NRDL, 1956-April 1959; Head, Thermal Injury Branch, NRDL 1952-1956; Investigator in Thermal Injury Branch, NRDL, April 1951-September 1952; Assistant Professor Pharmacology, George Washington University, Washington, D.C., January 1950-April 1951.

Enclosure (1)

Radiological Safety Committee Members and Qualifications

Dr. Edward R. Tompkins, Chairman

Chairman, Radiological Safety Committee, NRDL, November 1962 to date; Associate Scientific Director, NRDL, November 1961 to date; Scientific Liaison Officer, ONR, London, England, July 1960-October 1961; Head, Chemical Technology Division, NRDL, December 1951-June 1960; Consultant, NRDL, five (5) months-1951; Consultant, U.C. Radiation Laboratory, Berkeley, California-16 months; Assistant Manager and Director of Research for Scientific Service, Inc., Berkeley, California-18 months; Radiochemist, AEC, Advisory Field Service, Oak Ridge, Tennessee-six (6) months; Supervisor, Chemistry Department, Clinton Laboratory, Oak Ridge, Tennessee-four (4) years; Research Chemist, Armour Research Foundation, Chicago, Illinois, one (1) year.

Albert L. Smith, Alternate Chairman

Head, Health Physics Division, NRDL, February 1962 to date; Head, Radiological Safety Branch, Health Physics Division, NRDL, July 1956-February 1962; Health Physicist, NRDL, October 1951-July 1956; Health Physicist, General Electric Corporation, Hanford Atomic Products Operation, January 1948-October 1951.

Dr. Thomas R. Birdwell, LCDR, MC, USN, Alternate Chairman

Head, Medical Department, NRDL, July 1967 to date. Research Pathologist, Biological and Medical Sciences Division, NRDL, 1966-1967; Pathology Resident, Department of Pathology, U. S. Naval Hospital, San Diego, California, 1962-1966; Internship, U. S. Naval Hospital, Camp Pendleton, California, 1961-1962; M.D., Tulane University Medical School 1961.

Dr. Edward L. Alpen

Head, Biological and Medical Sciences Division, NRDL, April 1959 to date; Head, Biophysics Branch, NRDL, 1956-April 1959; Head, Thermal Injury Branch, NRDL 1952-1956; Investigator in Thermal Injury Branch, NRDL, April 1951-September 1952; Assistant Professor Pharmacology, George Washington University, Washington, D. C., January 1950-April 1951.

Radiological Safety Committee Members and Qualifications (Continued)

Dr. William E. Kreger

Head, Physical Sciences Division, NRDL, November 1966 to date; Head, Cyclotron Project, NRDL, July 1966-November 1966; Head, Nucleonics Division, October 1962-July 1966; Acting Head, Nucleonics Division, NRDL, 1961-1962; Head, Nuclear Radiation Physics Branch, NRDL, 1958-1961; Senior Investigator (Nuclear Physicist), Shielding Section, NRDL, 1952-1958.

Dr. Richard Cole

Head, Chemical Technology Division, NRDL, September 1964 to date; Head, Countermeasures Evaluation Branch, Military Evaluations Division, May 1959-September 1964; Radiological Chemist, Military Evaluations Division, December 1956-May 1959; Radiological Chemist, Chemical Technology Division, March 1952-December 1956.

Form AEC—410
(1-61)

UNITED STATES
ATOMIC ENERGY COMMISSION

SOURCE MATERIAL LICENSE

Pursuant to the Atomic Energy Act of 1954, and Title 10, Code of Federal Regulations, Chapter 1, Part 40, "Licensing of Source Material," and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, possess and import the source material designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations in said Part. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954 and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission, now or hereafter in effect, including Title 10, Code of Federal Regulations, Chapter 1, Part 20, "Standards for Protection Against Radiation," and to any conditions specified below.

Licensee	3. License No.
1. Name Department of the Navy	SMB-376, as renewed
2. Address U. S. Naval Radiological Defense Laboratory San Francisco, California 94135	4. Expiration Date July 31, 1972
	5. Docket No. 40-5063

6. Source Material	7. Maximum quantity of source material which licensee may possess at any one time under this license
Uranium - Thorium	560 pounds

CONDITIONS

8. Authorized use (Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.)

For use in accordance with the procedures described in the licensee's application dated June 29, 1967.

9. Authorized places of use: The address stated in Item 2 above and any Navy, Army or Air Force facility within the United States, provided the use of the material is under the supervision of the licensee.

Commander, Naval Electronics Systems Command

FROM: NAVELEX 0516
TO: ...CO.. AND. DIR, .NRDL.....

1. FORWARDED FOR YOUR RECORDS

7-26-67

C. S. HOLLANDER

2. SIGNATURE
By Direction

For the U. S. ATOMIC ENERGY COMMISSION

Date of issuance JUL 21 1967

Don F. Harmon

Don F. Harmon
Division of Materials Licensing

★ U. S. GOVERNMENT PRINTING OFFICE : 1962 O - 632985

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JUL 21 1967

IN REPLY REFER TO:
DML:CEM
40-5063

Department of the Navy
Naval Electronic Systems Command
Baileys Crossroads, Virginia 22041

Attention: Mr. M. G. Williams
Your reference: ELEX-0516
9900
Ser 310

Gentlemen:

Enclosed is Source Material License No. SMB-376, as renewed, for the U. S. Naval Radiological Defense Laboratory.

Very truly yours,

Don F. Harmon

Don F. Harmon
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
License No. SMB-376, as renewed

ELEX-0516
9900
Ser 301
10 July 1967

FIRST ENDORSEMENT ON USNRDL LETTER SERIAL 730-118 AK:kmm OF 30 JUNE 1967

From: Commander, Naval Electronic Systems Command
To: Chief
Source and Special Nuclear Materials Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: AEC Source Material License No. SUB-376; Application For Renewal Of

1. Basic letter with enclosure contains an application for renewal of subject license.

2. This material has been reviewed and the completed Form AEC-2(3-64) with supplemental material has been prepared in accordance with instructions provided with the form.

Copy to:
BUMED, Code 74
NRDL, 672A3

M. G. WILLIAMS
By direction

MAHAFFEY/mitchell
64000 - 7/10/67
Serial 670706-6361

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:

730-118
AK:kmm
30 JUN 1967

Received in 7/6/67
& routed to AEC by End (1)
0516 — 7/6 — July 1967

AIRMAIL

From: Commanding Officer and Director
To: U. S. Atomic Energy Commission (Division of Materials Licensing), Washington, D. C. 20545
Via: Commander, Naval Electronic Systems Command (Code 05163) Munitions Building, 18th and Constitution Avenues, Washington, D. C. 20390

Subj: AEC Source Material License SMB-376; request for renewal of

Encl: (1) Application for Source Material License (Renewal), Form AEC-2, with enclosures

1. This Laboratory's application for renewal of Source Material License SMB-376, enclosure (1), is submitted for review and approval.

D. C. CAMPBELL

671524

FORM AEC-2
(3-64)
Previous editions are obsolete.

FORM APPROVED
BUREAU OF BUDGET NO. 38-R002.

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
- ☐ (a) New license
- ☐ (b) Amendment to License No.
- ☒ (c) Renewal of License No. SMB-376
- ☐ (d) Previous License No.

2. NAME OF APPLICANT
U.S. Naval Radiological Defense Laboratory

3. PRINCIPAL BUSINESS ADDRESS
San Francisco, California 94135

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
(See supplement 1)

5. BUSINESS OR OCCUPATION
U. S. Navy

6. (a) IF APPLICANT IS AN INDIVIDUAL, STATE CITIZENSHIP
Not applicable

(b) AGE
Not applicable

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
~~The U. S. Naval Radiological Defense~~ Laboratory is a Laboratory engaged in basic and applied research on the physical, chemical and biological effects of nuclear and thermal radiation, with particular emphasis upon those factors relating to the requirements of the military services.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (*Including % U or Th.*)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (*in pounds*)
NATURAL URANIUM	Any	Any	50
URANIUM DEPLETED IN THE U-235 ISOTOPE	Any	Any	500
THORIUM (ISOTOPE)	Any	Any	10

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (*in pounds*)
560 Pounds

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.
(See supplement 2)

10. DESCRIBE THE MINIMUM TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE THAT WILL BE REQUIRED OF APPLICANT'S SUPERVISORY PERSONNEL INCLUDING PERSON RESPONSIBLE FOR RADIATION SAFETY PROGRAM (OR OF APPLICANT IF APPLICANT IS AN INDIVIDUAL).
(See supplement 3)

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).
(See supplement 4)

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).
(See supplement 5)

11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS. MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT.

(See supplement 6)

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

(See supplement 7 and Appendix A)

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

(See supplement 8 and Appendix A)

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

(See supplement 9 and Appendix A)

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here* ☒ *and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated.

(b) Detailed procedures for waste disposal. **(See supplement 10)**

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(*This item must be completed by applicant*)

15. *The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

U. S. Naval Radiological Defense Laboratory
(*Applicant named in Item 2*)

Dated 29 **June 1967**

BY: **E. R. TOMPKINS**
(*Print or type name under signature*)

Chairman, Radiological Safety Committee
(*Title of certifying official authorized to act on behalf of the applicant*)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U.S. GOVERNMENT PRINTING OFFICE: 1964—O-706-977 817-427-2

Supplement 1 (Item 4)

Material will be possessed and used by the U. S. Naval Radiological Defense Laboratory (NRDL), San Francisco, California 94135 and may also be used at Navy, Army and Air Force facilities provided such use is under the direct supervision and control of NRDL.

It may be sent out or transferred to other AEC or State licensed activities, including on/off-site chemical procedures by NRDL personnel at irradiation facilities authorized to conduct and/or allow such procedures to be performed.

Supplement 2 (Item 9)

Natural uranium in microgram to gram amounts is employed in ways similar to the following:

1. Calibration standards.
2. Ion exchange studies.
3. Neutron activation analysis.
4. Fission fragment track production.
5. Fission product production.

Uranium depleted in the U-235 isotope in microgram to gram amounts is used such as the following:

1. Standard sources.
2. Fission fragment track production.
3. Radiochemistry.
4. Neutron activation analysis.

Thorium from microgram to gram amounts is used in the following typical ways:

1. Fission fragment track production.
2. Radiochemistry.
3. Neutron activation analysis.

Radiological safety and contamination control measures are employed for all processes as outlined in Item 12 and Appendix A.

Supplement 3 (Item 10)

Radiological Safety Committee Members and Qualifications

Dr. Edward R. Tompkins, Chairman

Chairman, Radiological Safety Committee, NRDL, March 1967 to date; Chairman, Radioisotope Committee, NRDL, November 1962-March 1967; Associate Technical Director, NRDL, November 1961 to date; Scientific Liaison Officer, ONR, London, England, July 1960-October 1961; Head, Chemical Technology Division, NRDL, December 1951-June 1960; Consultant, NRDL, five months-1951; Consultant, U. C. Radiation Laboratory, Berkeley, California-16 months; Assistant Manager and Director of Research for Scientific Service, Inc., Berkeley California-18 months; Radiochemist, AEC, Advisory Field Service, Oak Ridge, Tennessee-6 months; Supervisor, Chemistry Department Clinton Laboratory, Oak Ridge, Tennessee-4 years; Research Chemist, Armour Research Foundation, Chicago, Illinois, 1 year.

Albert L. Smith, Alternate Chairman

Head, Health Physics Division, NRDL, February 1962 to date; Head, Radiological Safety Branch, Health Physics Division, NRDL, July 1956-February 1962; Health Physicist, NRDL, October 1951-July 1956; Health Physicist, General Electric Corporation, Hanford Atomic Products Operation, January 1948-October 1951.

Dr. Myron I. Varon, CDR, MC, USN, Alternate Chairman

Radiological Medical Director, NRDL, August 1965 to date; Ph. D. Department of Radiation Biology, University of Rochester, 1962-1965; Radiological Safety Officer, USS Long Beach, 1960-1962; AEC, Naval Nuclear Power Program, Idaho Falls, Idaho, 1959-1960; Armed Forces Special Weapons Project, 1958-1959; Medical Officer, USS Lenawee, (APA-195), 1956-1958; Internship, Cook County Hospital, 1955-1956; M. D., Northwestern University, 1955.

Dr. Edward L. Alpen

Head, Biological and Medical Sciences Division, NRDL, April 1959 to date; Head, Biophysics Branch, NRDL, 1956-April 1959; Head, Thermal Injury Branch, NRDL 1952-1956; Investigator in Thermal Injury Branch, NRDL, April 1951-September 1952; Assistant Professor, Pharmacology, George Washington University, Washington, D. C., January 1950-April 1951.

Dr. Richard Cole

Head, Nuclear Technology Division, NRDL, November 1966 to date; Head, Chemical Technology Division, NRDL, September 1964-November 1966; Head, Countermeasures Evaluation Branch, Military Evaluations Division, May 1959-September 1964; Radiological Chemist, Military Evaluations Division, December 1956-May 1959; Radiological Chemist, Chemical Technology Division, March 1952-December 1956.

Dr. C. Sharp Cook

Head, Radiation Physics Division, NRDL, November 1966 to date; Head Nucleonics Division, NRDL, November 1965-November 1966; Physics Consultant to Scientific Director, NRDL, 1962-1965; Fulbright Research Fellow, Aarhus University, Aarhus, Denmark, 1960-1962; Head, Nucleonics Division, NRDL, April 1960-August 1961; Head, Radiation Characteristics and Effects Branch, NRDL, 1959-1960; Head, Nuclear Radiation Branch, NRDL, 1953-1959; Assistant Professor, Physics, Washington University, St. Louis, Missouri, 1948-1953; Research Assistant, Indiana University, 1946-1948; Teaching Assistant, Indiana University, 1940-1942.

Paul E. Zigman

Head, Technical Management Office, NRDL, April 1964 to date; Head, Applied Research Branch, 1961-April 1964; Supervisor and Research Specialist, Atomics International, 1959-1961; Head, Analytical and Standard Branch, NRDL, 1955-1959; Investigator, NRDL, 1948-1955.

Dr. William E. Kreger

Head, Physical Sciences Division, NRDL, November 1966 to date; Director, Cyclotron Project, NRDL, November 1965-1966; Head, Nucleonics Division, NRDL, 1961-1965; Head, Nuclear Radiation Physics Branch, NRDL, 1958-1961; Senior Investigator (Nuclear Physicist), Shielding Section, NRDL, 1952-1957.

Each member has two alternates whose qualifications are commensurate with their positions, usually Branch Heads.

Supplement 4 (Item 11a)

Radiation detection instruments available at NRDL include the following:

Instrument	Type	Quantity on Hand	Range	Purpose
Victoreen Vamp Model 808A	End Window GM	2	0-50 mr/hr	β-γ continuous area monitoring alarm system.
Victoreen Model 440	Ionization Chamber	1	0-300 mr/hr	Broad energy range γ dose rate monitoring.
Berkeley 2750	Side Window GM	27	0-50,000 c/m	β-γ dose rate and contamination monitoring.
Eberline E112B	Side Window GM	6	0-20 mr/hr	β-γ dose rate and contamination monitoring.
Nuclear 1615B	End Window GM	3	0-50,000 c/m	β-γ dose rate and contamination monitoring.
AN/PDR 27	End Window GM Enclosed GM	67	0-5 mr/hr 0-500 mr/hr	β-γ dose rate and contamination monitoring.
E1-Tronics CP3D (Cutie Pie)	Ionization Chamber	13	0-10 rad/hr	β-γ dose rate monitoring.
CP3DM (Cutie Pie)	Ionization Chamber	25	0-10 rad/hr	β-γ dose rate monitoring.

Supplement 4 (Item 11a) (Continued)

Instrument	Type	Quantity on Hand	Range	Purpose
CP3DMS (Cutie Pie)	Ionization Chamber	10	0-100 rad/hr	β- γ dose rate monitoring.
AN/PDR-TIB	Ionization Chamber	18	0-50 r/hr	γ dose rate monitoring.
Keleket K-240	Five Fold (GM)	1	10^4 Counts	β- γ hand and foot counter.
Austin, Model 4	Five Fold (GM)	2	10^4 Counts	β-γ hand and foot counter.
IM-113 A/PDR	Side Window GM	26	0-20 mr/hr	β-γ dose rate and contamination monitoring.
Juno No. 3	Ionization Chamber	5	0-5000 mr/hr	α β- and γ dose rate and contamination monitoring.
Berkeley 2750 (Modified)	End Window GM (with thin window)	2	0-50,000 c/m	Low energy beta monitoring.
Eberline PAC 3G	Gas Proportional	12	0-100,000 c/m	α contamination monitoring.
Eberline (PAC ISA)	Scintillator	8	0-2,000,000 c/m	α contamination monitoring.
Ludlum Model 11 with High Density Polyethelene Moderators	Scintillator	1	0-50,000 Counts per Minute	Neutron dose rate monitoring.

Supplement 4 (Item 11a) (Continued)

Instrument	Type	Quantity on Hand	Range	Purpose
Victoreen Model 488	BF_3 Proportional Counter	1	0-80,000 Counts per Minute	Neutron dose rate monitoring.
NRDL Tritium Meter	Ionization Chamber	1	10^{-3} μc/cc sensitivity	Tritium air contamination monitoring.
T-289 Tritium Detector	Ionization Chamber	3	10^{-5} μc/cc sensitivity	Tritium air contamination monitoring.
T-290 Tritium Detector	Ionization Chamber	2	10^{-3} μc/cc sensitivity	Tritium air contamination monitoring.
Dosimeters IM-9E/PD	Direct reading pocket chamber	73	0-200 mr	γ personnel dosimetry.
Dosimeter, Bendix Model 866	Direct reading pocket chamber	19	0-1R	γ personnel dosimetry.
Dosimeter, Bendix Model 611	Direct reading pocket chamber	25	0-5R	γ personnel dosimetry.
Dosimeter IM-19B/PD	Direct reading pocket chamber	25	0-10R	γ personnel dosimetry.
Dosimeter, Landsverk with adjustable finger ring	Indirect reading pocket chamber	10	0-2R	γ personnel hand dosimetry.
Reader-Charger Landsverk	Electrometer	1	--	Reading and charging indirect reading pocket chamber.
Dosimeter Charger Bendix, Model 850	Battery operated	5	--	Charging direct reading pocket chamber.

Supplement 4 (Item 11a) (Continued)

Instrument	Type	Quantity on Hand	Range	Purpose
Dosimeter Charger, Keleket	Battery operated	8	--	Charging direct reading pocket chamber.
Radiac Detector Charger, PP-311 A/PD Victoreen	Battery operated	3	--	Charging direct reading pocket chamber.
Film Badge	DuPont 555 and 1290 filter film holder	9000	25 mr to about 3000 r	β-γ personnel dosimetry.
Film Badge	Eastman NTA film	65	20 mrem to 10,000 mrem	Fast neutron personnel dosimetry.
Film Badge finger ring	DuPont 508 and 1290	15	25 mr to about 3000 r	β-γ personnel hand dosimetry.
Staplex, high volume	Air Sampler	16	25 cfm	α β-γ aerosol sample collection.
Schmidt, low volume	Air Sampler	10	1.75 cfm	α β-γ aerosol sample collection.
Port-A-Vac	Air Sampler	5	6×10^5 cc/min.	α β-γ aerosol sample collection.
Nuclear-Chicago Model 151A with scaler interchangeable end window GM and side window GM	GM Counter	1		β-γ air, water and wipe sample counting.

Supplement 4 (Item 11a) (Continued)

Instrument	Type	Quantity on Hand	Range	Purpose
Berkeley Scaler (1-218) with end window GM	GM Counter	1		β-γ air, water and wipe sample counting.
RCL Scaler with end window GM	GM Counter	1		β-γ air, water and wipe sample counting.
Radiation Instruments Development Laboratories Scaler with Scintillation Counter	Scintillation Counter	1		α air, water, and wipe sample counting.
Nuclear-Chicago Scaler Model 202 with interchangeable alpha and beta scintillation counter	Scintillation Counter	1		α β air, water and wipe sample counting.
Baird-Atomic Single Channel Spectrometer with 4"x4" sodium iodide thallium activated crystal	Scintillation Counter	1		γ air, water and wipe sample counting and isotope identification.
Nuclear-Chicago Model 186A Scaler with gas proportional counter	Gas Proportional	1		α β and low energy beta air, water and wipe sample counting.
Baird-Atomic Model 132 Scaler with end window GM	GM Counter	1		β-γ air, water and wipe sample counting.

Supplement 4 (Item 11a) (Continued)

Handling and storage equipment and facilities available at NRDL includes the following:

1. Twelve shipping containers, lead-shielding thickness ranging from 2" to 11".
2. 100 storage containers, 1" lead.
3. 32 storage containers, 2" lead.
4. 28 storage containers, 3" lead.
5. One concrete-shielded storage vault for isotope storage containers.
6. One concrete-shielded storage vault for radiation sources.
7. Two-fenced-storage areas for contaminated equipment.
8. Twenty remote pipettes for isotope solution transfers.
9. Two sets of master-slave manipulators.
10. Two concrete-walled hot cells.
11. Four lead-shielded glove boxes.
12. Twelve glove boxes, unshielded.
13. Miscellaneous remote-handling tongs.
14. Sixteen radiobiological laboratories with 43 fume hoods.
15. Twenty-three radiochemical laboratories with 43 fume hoods.
16. Three radiophysics laboratories with 3 fume hoods.
17. One mobile radiological safety monitoring and protective equipment supply station.
18. Portable shielded master-slave manipulator.
19. Emergency decontamination equipment station.

20. Specifically marked dry and liquid radioactive waste containers.

21. Two fenced areas for storage of radioactive waste for ultimate disposal by AEC licensed waste contractor.

Bioassay screening of personnel is accomplished by gross beta determinations. Rare earths and heavy metals are precipitated from urine by a reagent containing ammomium oxalate, oxalic acid and acetic acid. The precipitate is beta counted.

Uranium is separated from urine by ion exchange methods and counted for alpha and/or beta activity.

A whole-body counter with a 4" x 4" NaI crystal shielded by an 8" iron wall room and coupled to a 100 channel spectrometer provides a means for estimating the quantity and identity of gamma-emitters in the body. This counter is used in cases of suspected body uptake of certain radioelements.

Supplement 5 (Item 11b)

Radiation detecting instruments are calibrated every three months or as needed (instrument malfunctions, etc.) by electronic technicians on a calibrated source range. Sources used are Cobalt-60, Cs-137, Pu-Be, U-238. Prior to use of the instrument, a check is made with a radioactive test sample (Ra-226, Cobalt-60, Sr-90, Pu-239) to insure instrument operation.

Counting systems are initially calibrated for operating plateaus and checked daily with calibrated standards for instrument performance. When counting systems are serviced they are then recalibrated.

Occasionally checks are made of air samplers to establish the air flow rate.

The standard film badge dosimeter used at NRDL has five filters of thickness 0.032" aluminum, 0.027" lead, 0.015"cadmium, and 0.010" paper and 0.125" plastic. It can be calibrated so as to give effective energy information as well as dosage information. The film used is a two-film packet, containing DuPont 555 and 1290 film, and can measure gamma exposures from 25 mr to about 3000 r.

The DuPont 555 and 1290 films are calibrated for response to beta radiation with a normal uranium plaque, and for response to gamma radiation with a Cobalt-60 source, and various energies of X-ray, using NBS-certified thimble chambers as a standard. All calibration exposures are made with the film inside the badge.

Neutron film badges (NTA film) are also used when neutron sources are handled, or when personnel are in proximity to nuclear reactors or neutron producing particle accelerators. A neutron film badge service is supplied by a commercial firm (Radiation Detection Company, Mt. View, California).

Finger ring film badges (beta-gamma) are used whenever there is the possibility of hand exposure in excess of that measured by the body badge. A finger ring service is supplied by a commercial firm (Radiation Detection Company, Mt. View, California).

Supplement 6 (Item 11c)

All spaces where radioactive material is employed are ventilated. The system is basically as follows:

Each floor has its own air intake and exhaust systems. Air is drawn in at each floor level and then exhausted to the roof through separate ducts. Thin fiberglass filters are used on the intake air, which also is cooled or heated as necessary. Exhaust air is filtered in only those spaces having hoods. Two commercial types of fiberglass filters are employed for this purpose. One is a throw-away type, while the other has a higher capacity and is used for low level radioactive exhausts. All filters are changed as performance requires.

The policy for hood work is that no aerosol producing operations are to be conducted in the hoods, special containment systems such as glove boxes are used instead. One hood, however, was outfitted with a separate extra high capacity filtered exhaust system, in our radioisotope storage room. This hood is available for work wherein airborne contamination may be a problem. The face velocity of all hoods was set at 100-125 linear feet per minute.

For failures within the supply system, i.e., fan breakdown, etc., there is a provision for switching from one fan to another. In case of a power failure, after a period of 9 seconds, emergency power is supplied to the exhaust fans only. It is estimated, under these conditions that about 30% of normal supply air is drawn into the building through the supply system ducts, though the supply fans are off.

Supplement 7 (Item 12a)

The Health Physics Division of the Laboratory is responsible for the protection of Laboratory personnel and the environment from radiological and industrial hazards.

This includes adequate radiological safety measures for all Laboratory personnel working in spaces where radioactive material is handled. Special monitoring services are provided where any experimental or maintenance operation involves an unusual radiological hazard. These services include monitoring film badges, pocket dosimeters, and appropriate radioclinical examination for internal contamination. A supply of calibrated monitoring instruments, adequate to measure all types of radiations, is maintained for the Health Physics Division and self-monitoring purposes. An active air sampling program guards against buildup of hazardous airborne concentrations of radioactive materials.

The Radiological Health Division of the Laboratory performs physical examinations, including radio-urinalysis, for all personnel entering or leaving the employ of the Laboratory, and additional examinations during employment as required by the nature of the work.

The responsibilities of the Health Physics Division include the control and accountability of all radioisotopes including source materials used in the Laboratory.

The control procedures requires the use of specific forms. Individual use-approval forms, called NRDL Form 44 and 44A (Figures 1 and 2) are initiated by each experimenter when a particular radioactive material is required. This experimental plan is reviewed by the Division Radiological Safety Committeeman who has supervisional cognizance over the experimental program. When he has approved the completed form, it is submitted for review to the Health Physics Division. The Health Physics Division investigates the request and recommends safety requirements for the particular experimental setup, on NRDL Form 76, Isotope Procurement Investigation (Figure 3). The Form 76 is then submitted with the completed Form 44 to the Chairman of the Radiological Safety Committee for review and final approval. A purchase order and procurement of the radioisotope is then processed, after final approval is granted.

Supplement 7 (Item 12a) (Continued)

All shipments of radioactive material are delivered, unopened, to the Health Physics Division where Health Physicists, or technical personnel under their supervision, open the package. In each instance they conduct a radiological survey, perform any necessary decontamination, and determine, the activity content of the material. A record is made which shows the identity, quantity, activity, and location of the material. This record is maintained as long as the material is at NRDL.

All radioactive material is stored, when not in use, in a subterranean storage vault in the isotope storage room. This room has walls of reinforced concrete 36" thick and a locked door. The storage vault consists of 40 stainless steel cylinders each holding four (4) lead containers. These lead containers are divided into three effective shielding thicknesses (1", 2", and 3"). The containers are removed from the storage vault by a remote controlled traveling crane of 3 ton capacity. To avoid non-nuclear accidents in storage and experimental areas, the following is carried out:

Personnel are indoctrinated in safety and good housekeeping practices for Laboratory operations by their immediate supervisors. Work spaces are grouped together away from unprotected areas such as the library, auditorium, and secretarial offices. Volatile and combustibles are stored away from nuclear materials. Laboratory buildings are inspected daily by the Guard Force and the Safety Officer who are instructed to look for fire hazards and report them for remedial action. San Francisco Bay Naval Shipyard Fire Department officials regularly examine NRDL fire fighting facilities and make additional recommendations. Off-hours inspections are made at frequent intervals by the Guard Force and the Laboratory Duty Officer to insure plant safety.

RADIOISOTOPE USE APPROVAL
12ND NRDL-44 (Rev 3/65)

1. Prepare original and 2 complete copies, including any sketches, drawings, etc.
2. Forward all 3 copies, as provided.
3. Use form 12ND NRDL-44A for variations from previously approved form 12ND NRDL-44.
4. Form 12ND NRDL-44 should be resubmitted after a period of one year.

ROUTING	CODE	APPROVAL SIGNATURE	DATE
From Branch			
To Radiological Safety Chairman, ~~Radioisotope~~ Committee	901		
Via Radiological Safety (1) Division ~~Radioisotope~~ Committeeman			
(2) Health Physics Division	730		

It is requested that approval be granted for the use and the manner of use for the following radioisotopes.

Radioisotopes	Chemical Form	Special Irradiation Service
Quantity (mc or gram)	Date Required	Activity Per Experiment~~al~~
Location of Use	Zone Level	AUTHORIZED USERS

NAME	CODE

WASTE CONCENTRATIONS AND AMOUNTS

Gas

Liquid

Solids

Experimental Title or Brief Description

Proposed Procedure (Attach sketch or description of apparatus)

Radiological Safety Precautions to be Taken by the Investigator

Supplement 7 (Item 12a) — Figure 1

MODIFICATION OF RADIOISOTOPE USE APPROVAL
12ND NRDL-44A (Rev. 1/6[illegible])

1. Use only when modifying original request, Form 12ND NRDL-44.
2. Prepare original and 2 copies, including sketches, drawings, etc., if any.
3. After Branch Head has signed forward all copies to Code 730.

From (Branch Code)	Date	Investigator & Room No.	Previous Stub No. Reference

To	Via
Chairman Radiological Safety Committee, Code 901	Health Physics Division, Code 730

It is requested that the following modification of original 12ND NRDL-44 be approved:

Signature of Branch Head	Signature of Chairman, Radiological Safety Committee

Supplement 7 (Item 12a) Figure 2

RADIOISOTOPE USE INVESTIGATION
12ND NRDL-76 (Rev 6-75)

Adequate Safety Precautions Being Taken in Experiment ☐ Yes ☐ No

Special Equipment Requirements and Comments

Signature of Health Physics Investigator	Date
Reviewed by Head, Health Physics Division	Date

Supplement 8 (Item 12b)

In the event of a spill or other radioisotope release, priority action is given to containment or contamination and prevention of personnel exposures. Personnel decontamination, if required, is initiated immediately. As soon as possible, bioassay sampling and whole body counting is accomplished. Area decontamination and correction of the cause of incident follows.

To cope with fires, glove boxes are equipped with dry powder and/or liquid chemical fire extinguishers. In addition, CO_2 and H_2O fire extinguishers are conveniently located throughout NRDL buildings. Buildings are equipped with automatic sprinkler systems and fire hose stations. The Laboratory is evacuated in event of fire by public address system notification. Personnel required for duties associated with combating fire remain in the building. The local Fire Department of the San Francisco Bay Naval Shipyard has been provided with information as to the Laboratory fire fighting problems. Familiarization fire drills are carried out on a periodic basis.

Supplement 9 (Item 12c)

Spaces where source material is used or stored are routinely surveyed on a scheduled basis. A routine monitoring program is also conducted in spaces where radioactive materials are not normally used. Periodic checks for radiation levels and removable contaminants provide an overall look at the radiological situation in the Laboratory. The monitoring consists of surveys for radiation and contamination levels with portable radiation detection instruments and by wipes of several areas in the space for evidence of removable activity. Air sampling is also conducted if there is a possibility of contaminated aerosol. Any potentially serious condition is called to the attention of the scientific investigator for corrective action.

Results of monitoring surveys are recorded on Form 12ND NRDL-342, Monitoring Report (Figure 1). Results of wipes surveys and air samples are recorded on Form 12ND NRDL-493, Health Physics Division Counting Data (Figure 2).

In spaces where radioactive material is being used that might present a potential aerosol hazard, continuous air sampling is conducted during the experiment. These are evaluated at various intervals throughout the experiment.

Film badges are placed throughout Laboratory spaces to detect any hazardous radiation levels. These are processed on a scheduled basis.

A continuous monitoring program is conducted to measure the radiation levels at the boundaries of the Laboratory's restricted area and to assess the release of radioactive materials to the Laboratory's environs. Air samples are collected continuously at the extremities of the Laboratory as well as within the Nuclear Technology Division's hood exhaust system. The hood exhaust sample is monitored during collection with a warning level indicator. All Laboratory liquid effluents (except sanitary drains) are held in storage tanks and assayed on a routine basis. The radioactivity concentration must be below the guide listed in 10 CFR 20 prior to release to the sewage system.

~~SPECIAL~~ MONITORING REPORT
12ND NRDL-342 (Rev 3/60)

Date | Report No.

Location:

Description:

Time	Object Monitored	Distance	Instrument Used	Radiation Intensity		
				Meter Reading		Scale Unit
				Shield Open	Shield Closed	

Comments:

Monitored by:

Sample Description _____

Counted by		Scaler Detector Shelf		Type of Radiation		Date	Standard	Remarks
Sample No.	Time Counted	Total Count	Detr. Time/Min.	Total Count Rate (C/M)	Bkg. C/M	Net Count Rate (C/M)	Dis./ Min.	
BKG.								
STD.								

HEALTH PHYSICS DIVISION COUNTING DATA
12ND NRDL-493 (Rev 11/63)

Supplement 9 (Item 12b) Figure 2

Supplement 10 (Item 13a)

The type of waste generated will be either liquid or solid. For any airborne active waste, it is first filtered before release to the environment. Any waste generated during an experiment will be in milligram or less amounts. The total amount of waste in the holding area will not exceed gram amounts before being collected by waste disposal contractor.

Supplement 10 (Item 13b)

Dry and liquid waste containers are provided in all laboratory spaces where radioactive material is used or stored (Figures 1 and 2). They are emptied routinely when 3/4 full or when monitoring surveys indicate they should be removed from the area. While no upper radiation level for removal of a waste container has been set, it is general policy to keep the levels as low as possible.

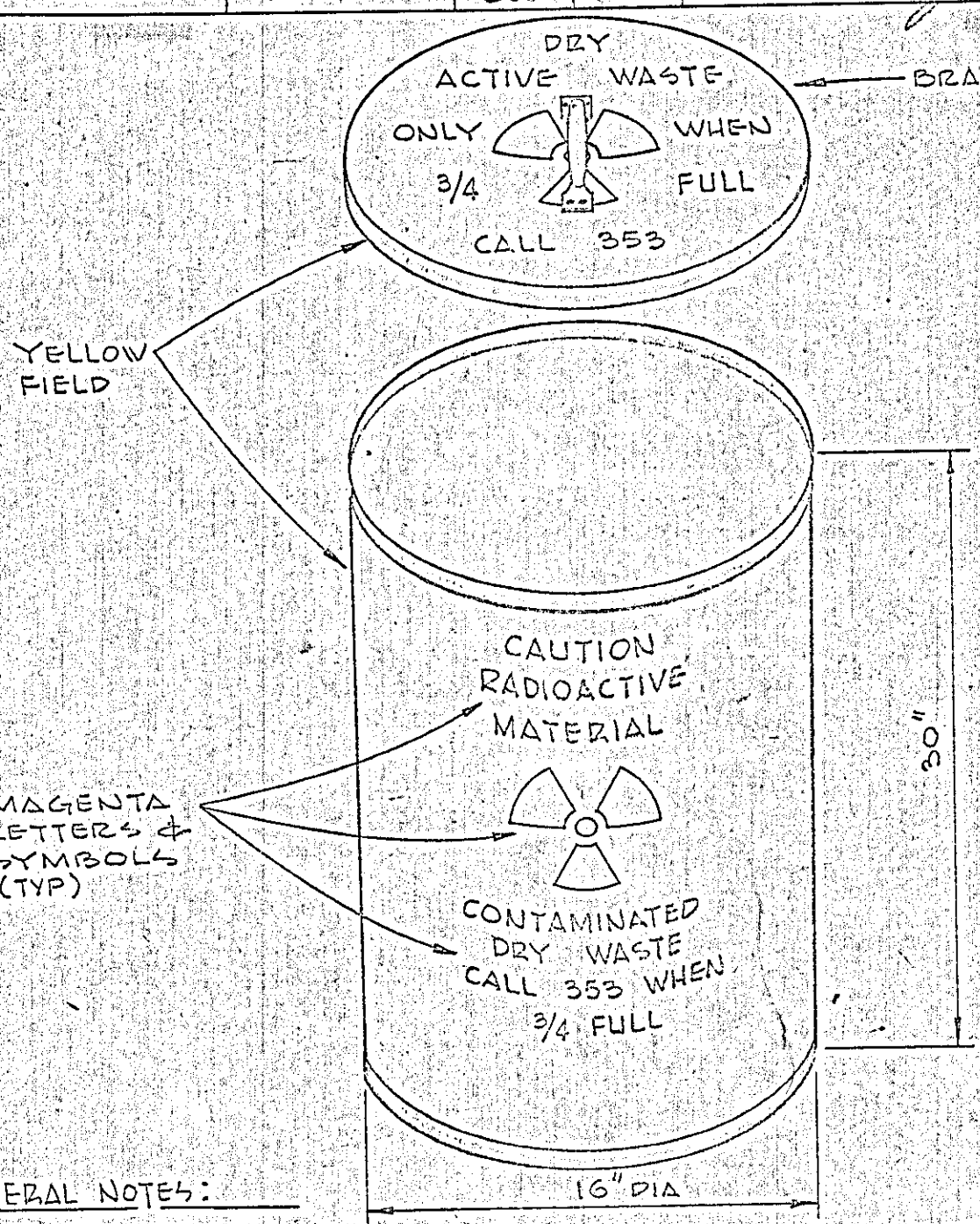
The wastes are removed to either of two fenced areas for treatment appropriate to the type of waste. Solid wastes are packaged for disposal in "Strong, Tight Crates" (Figure 3) with suitable shielding, if required, being incorporated to maintain radiation levels within the maximum permitted by ICC regulations. Liquid wastes are held for disposal in glass lined underground tanks. Liquid wastes containers are removed to the storage area and are neutralized to approximately pH 7 before being placed in the holding tanks.

Ultimate disposal of all solid and liquid waste is to an AEC licensed waste contractor. At present, there are two local contractors who are capable of accepting these radioactive material wastes. They are as follows:

1. Nuclear Engineering Company, Inc.
   64 Ray Street
   Pleasanton, California

2. California Nuclear, Inc.
   Post Office Box 59
   60 Industrial Row
   Cowell, California 94524

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY SAN FRANCISCO 24 CALIFORNIA	SCALE	DATE 6-4-65	PROJECT NO.
TITLE SOLID RADWASTE CONTAINER	DRAWING NO. M-65-102		ALTERATION
DRAWN BY FJA	CHECKED BY RPM	APPROVED [illegible]	SATISFACTORY TO [illegible]	DATE 7 June 65

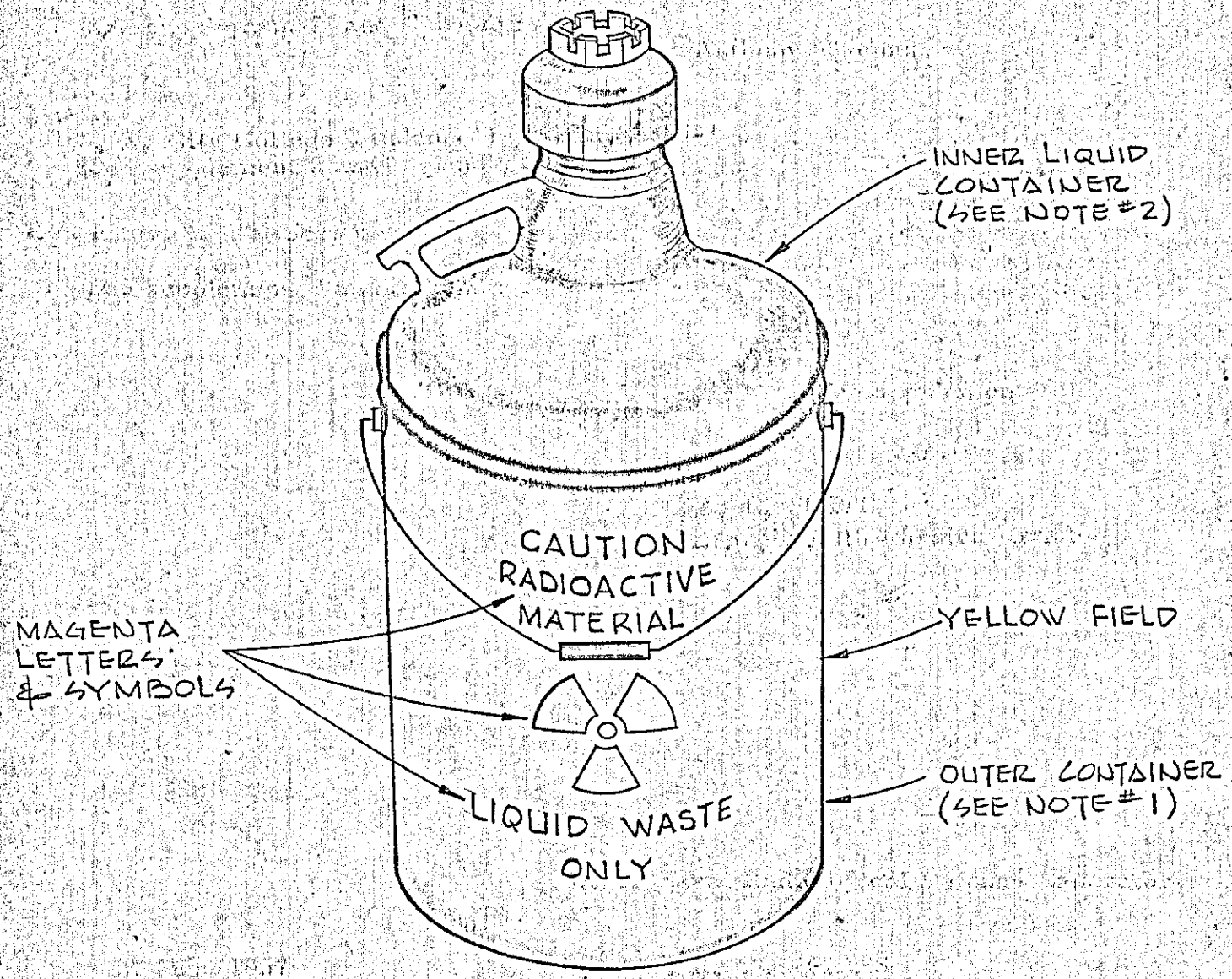


GENERAL NOTES:

1. CONTAINER MATERIAL: FIBER DRUM.
2. CONTAINER TO BE LINED WITH REMOVABLE POLYETHYLENE BAG.
3. RADIATION SYMBOL TO BE 4" DIA., ALL OTHER DIMENSIONS AS PER NRDL DWG. M-58-79. LETTERS TO BE $\frac{3}{4}$" HIGH MIN.
4. SAME DESIGN ON OPPOSITE SIDE & LID OF CONTAINER.
5. ALL DIMENSIONS ARE APPROXIMATE.

Supplement 10 (Item 13b) Figure 1

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY SAN FRANCISCO, CALIFORNIA	SCALE	DATE 6-2-65	PROJECT NO.
TITLE LIQUID RADWASTE CONTAINER	DRAWING NO. M-65-101		ALTERATION
DRAWN BY FJA	CHECKED BY RPM	APPROVED BY GJS	SATISFACTORY TO G.W. Kennedy	DATE 7 June 65

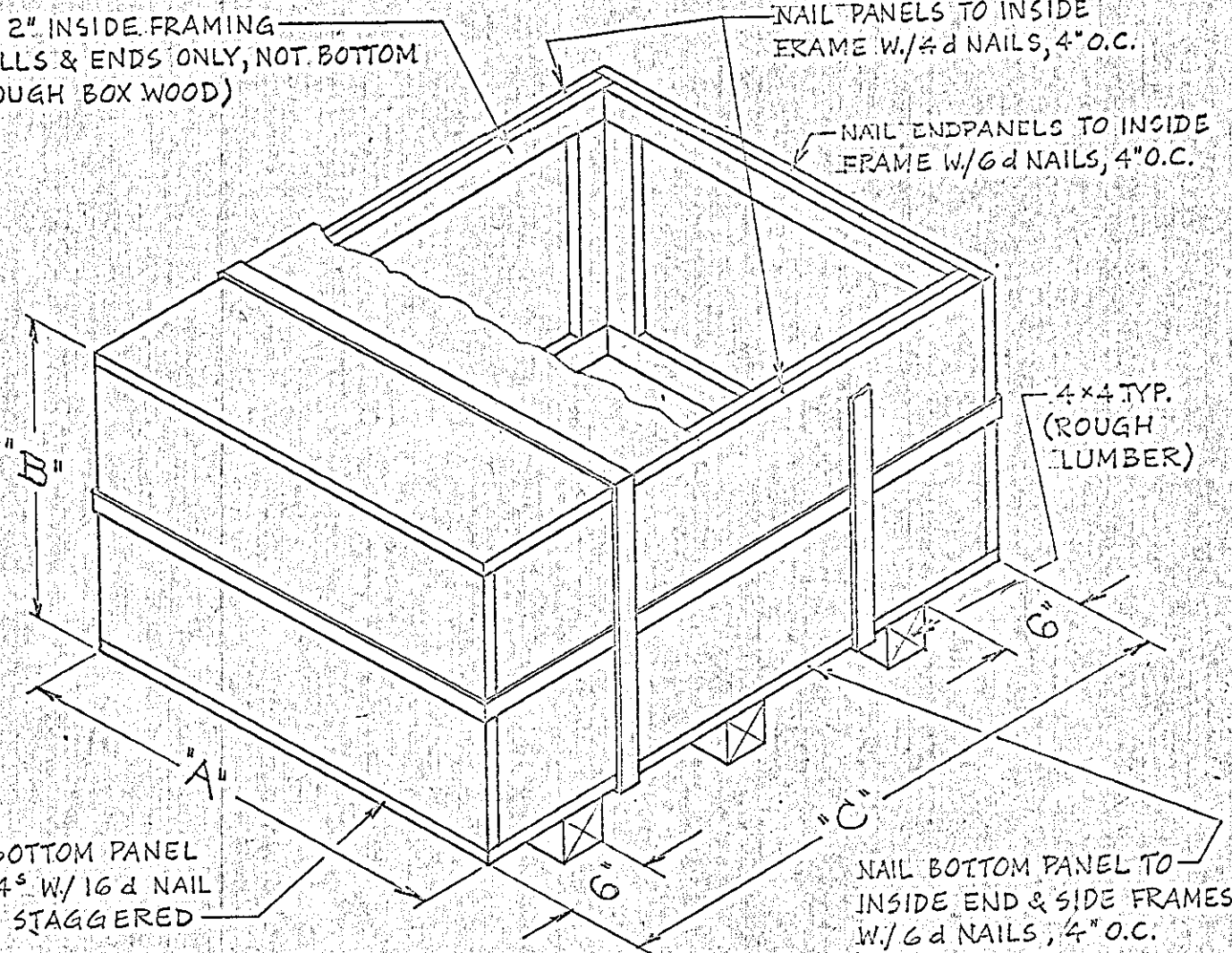


GENERAL NOTES

1. OUTER CONTAINER: 5 GALS (US) UNIVERSAL PAIL, ICC 37A, 24 GA.
2. INNER LIQUID CONTAINER: CARBOY, POLYETHYLENE, 5 GAL SIZE WITH HANDLE & SCREW CAP.
3. RADIATION SYMBOL TO BE 4" DIA., ALL OTHER DIMENSIONS AS PER NRDL DWG. M-58-79. LETTERS TO BE $\frac{3}{4}$" HIGH MIN.
4. SAME DESIGN ON OPPOSITE SIDE OF CONTAINER.
5. ALL DIMENSIONS ARE APPROXIMATE.

Supplement 10 (Item 13b) Figure 2

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY SAN FRANCISCO 24 CALIFORNIA	SCALE NONE	DATE 8-26-64	PROJECT NO.
TITLE RADWASTE DISPOSAL BOX	DRAWING NO. 246C-769		ALTERATION
DRAWN BY G.S.	CHECKED BY	APPROVED BY	SATISFACTORY TO	DATE



BOX SCHEDULE			
	"A"	"B"	"C"
TYPE I	44	24 5/8	91 1/2
TYPE II	44	24 5/8	96

GENERAL NOTES:

1. MAKE BOX FROM 5/8" THICK PLYWOOD GRADE C-D INTERIOR UNSANDED.
2. USE CEMENT COATED NAILS.
3. INSTALL 3/4" WIDE STEEL BANDS AS SHOWN AFTER PACKING IS COMPLETED.

Supplement 10 (Item 13b) Figure 3

APPENDIX A

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
San Francisco, California 94135

NRDL 5100.10A
730
8 December 1966

NRDL INSTRUCTION 5100.10A

From: Commanding Officer and Director
To: Distribution List C

Subj: Radiological Safety

Ref: (a) NRDLINST P5100.11, Radiological Safety Manual, NRDL
(b) Radiation Health Protection Manual, NAVMED P-5055
(c) Title 10, Code of Federal Regulations

1. Purpose. To restate the program of radiological health and safety in Laboratory operations, and to redefine responsibilities for its effective implementation.

2. Cancellation. This Instruction cancels NRDLINST 5100.10 and Supplements 1 and 2, NRDLNOTE 5100 of 24 August 1966 and NRDLINST 5100.1.

3. Scope. The radiological safety program applies to operations in all work areas under Laboratory control, including field locations. The program will consist of

(1) training and indoctrination,
(2) environmental monitoring,
(3) personnel monitoring,
(4) contamination control measures and protective equipment usage,
(5) medical examinations, and
(6) accountability and control of radioactive materials.

The program does not apply to hazard situations associated with nuclear weapons.

4. Policy. The serious nature of radiation hazards calls for the most scrupulous observance of precautions. It is Laboratory policy that exposure to ionizing radiation be permitted only in cases of valid necessity and that it be held to a minimal level.

5. Licensing and Control. It is essential that all personnel be made aware that this Laboratory's use of radiation sources is subject to licensing, control and inspection by the U. S. Atomic Energy Commission. Compliance with all provisions of the license is therefore a necessity.

6. Responsibilities.

a. Technical Division Heads. The Head of each Technical Division shall be responsible for the effective dissemination of radiological safety rules and regulations within his division, for making personnel available at reasonable times for radiological safety training and instruction, and for overall safety of operations in work areas assigned his division.

b. Technical Investigator. Each technical investigator using radiation sources will be responsible for strict observance of prescribed rules of radiological safety, as applicable both to personnel and to visitors, in work areas assigned to him.

c. Health Physics Division. The Head of the Health Physics Division (Code 730) shall serve as Radiological Safety Officer for the Laboratory, with responsibility for supervising the execution of the radiological safety program. Code 730 will provide consultation as needed in the implementation of controls for the hazards associated with radiation sources and the effectiveness of these control measures.

d. Radiological Medical Director. The Radiological Medical Director (Code 700) will supervise the combined radiological health and safety program and continuously advise the Commanding Officer and Director (Code 100) with regard to its effectiveness.

e. Radiological Safety Committee. The Radiological Safety Committee shall, in advance of purchase, review and approve proposals for use of radioisotopes and irradiation services. In addition, this Committee will serve as a review board in cases of excessive exposure or hazards.

7. Radiological Safety Manual. The rules of radiological health and safety in NRDL operations will be found in reference (a), which is based on references (b) and (c). References (b) and (c) are available in Code 730 for examination by any NRDL member.

D. C.

NRDLINST. P5100.11
December 1966

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
RADIOLOGICAL SAFETY MANUAL

Prepared by
Health Physics Division
U.S. Naval Radiological Defense Laboratory
San Francisco, California 94135

TABLE OF CONTENTS

EMERGENCIES

(Where there is radioactive material)

1. NOTIFICATION

a. Contamination: Health Physics Division . . . . . Ext. 240

b. Injuries: Radiological Health Officer . . . . . Ext. 235

c. Fire: Telephone Operator . . . . . Ext. "0"

After Normal Working Hours -- First inform Laboratory Duty Officer, Extension 318, who will in turn notify proper Departments.

2. PERSONAL DECONTAMINATION

a. Contaminated Wounds. Flush the wound under cold running water and await the arrival of the Radiological Health Officer.

b. Contaminated Skin. Wash the skin with soap and water, taking care not to spread contamination to clean area. Further instructions will be given by the Radiological Health Officer and the Health Physicist. Skin decontamination kits are located in Rooms 2179 and 218, respectively in Building 815.

3. FIRE IN RADIOACTIVE AREAS

Evacuate area immediately. Notify telephone operator or Extension 318, specifically stating that the fire involves radioactive material. Re-entry into the area shall be made only by fire fighting personnel. The Health Physicist will act as technical advisor to fire fighting personnel.

4. AREA CONTAMINATION

Evacuate the contaminated room and minimize the movement of personnel into other clean areas so as to control the spread of contamination. Re-entry into the accident area and subsequent decontamination measures will be contingent upon recommendations of the Health Physicist.

INTRODUCTION

1. General

This manual is intended to serve as a guide to Laboratory personnel in work operations involving radiation or radioactive materials and as general informational material concerning the Laboratory's radiological safety program.

2. Laboratory Policy

The basic principles of radiological safety operations are:

a. Radiological safety is a responsibility of the individual. Every employee must know the radiological safety aspect of his normal duties and perform these duties in a manner that will assure the safety of himself and others.

b. Every supervisor is responsible for the safety of the operations under his control.

c. Each Division will be responsible for its own radiological safety. Division Heads will review the work practices of personnel under their supervision to assure that they are adequate.

d. Radiation and contamination will be confined at the source insofar as practical. Radiation and radioisotope sources will not jeopardize other users, either from the point of view of health protection or the conduct of experiments. Non-radioactive tracers will be used wherever possible, particularly in connection with aerosol transport and distribution problems. Engineering-scale test, effectiveness, and evaluation projects, as well as radiation shielding and scattering experiments which require full-scale structures and sources of greater than 10 curies in the open and unconfined will be conducted at an Engineering Field Test Station.

e. The Health Physics Division will act as an audit and advisory agency to the Laboratory in all matters of radiological safety. It will provide consultation and monitoring service wherever requested, and will carry out routine monitoring and inspections sufficient to guard against personal overexposure and against increase of radiation background that would interfere with measurements.

f. Radiation exposure, at any level, should be incurred only if there is a valid necessity for such exposure.

3. External Guides

The Laboratory obtains and uses radioactive materials under licenses granted by the U. S. Atomic Energy Commision. Under these licenses, the

Laboratory is subject to inspection and control requirements as outlined in the Code of Federal Regulations, Title 10. Certain prohibitions are specified. For instance, radioisotopes may not be used in or on humans unless a specific license permitting that use is obtained. Certain radioisotopes and quantities of radioisotopes may not be brought on board unless specified in a license. For information concerning the scope and limitation of licenses held by NRDL, the Health Physics Division should be contacted.

SECTION I

REGULATIONS AND PROCEDURES FOR WORKING WITH AND HANDLING RADIOACTIVE MATERIALS

1. Rad-Safe Procedures

a. Zone Precautionary Measures

(1) Zone Designations. Laboratory areas are divided into four zones, as follows:

Zone 1 - Radioactive Material not Permitted. Examples: cafeteria, auditorium, offices on the 3rd floor, escalators, etc.

Zone 2 - Background Control Required. Examples: counting rooms, film storage and developing areas, laboratories for radiochemical urinalyses and tracer studies. Contamination control procedures required and must be formally documented.

Zone 3 - Radiation Area. Examples: work areas where radioactive material may be handled routinely.

Zone 4 - High Radiation Area. Examples: work areas in which the radiation level is such that a major portion of the body could receive greater than 100 mrem/hr; work areas in which an aerosol greater than 10 times the RCG is generated. Dosage and contamination controls are required and must be formally documented.

Supervisors will determine the zone level of all work areas under their control, with advice from personnel of the Health Physics Division, Code 730, as necessary.

A chart showing the zone level of all NRDL work spaces will be maintained and posted in the Code 730 office.

(2) Zone Markers. The zone number will be conspicuously posted for Zones 2, 3, and 4. ANY SPACE THAT DOES NOT DISPLAY A ZONE NUMBER SHALL BE CONSIDERED A ZONE 1 AREA. Zone markers will be standardized by Code 730 and posted by the Engineering Division, Code 240, in accordance with the information provided by the appropriate supervisor.

b. Contamination Control

Use of radioactive materials presupposes the potential spread of contamination between contaminated and clean areas by the movement of personnel and equipment. The following controls are established:

(1) Personal Protection. No eating, smoking or drinking should be done in spaces where radioactive material is used or stored (Zones 2, 3, and 4). Nothing whatsoever shall be put into the mouth, this includes pipettes and stems of wash bottles.

All open cuts will be covered before working with radioactive materials.

Gloves will be worn when handling objects that may be contaminated.

Protective clothing or equipment will not be taken into any area where food is stored, prepared or eaten. Protective clothing shall not be worn in the cafeteria.

Food containers or utensils of any kind will not be used for storing or handling radioactive materials.

A careful self monitoring survey will be made on all personnel after work with radioactive materials in quantities in excess of those listed in Appendix C, no matter whether they are leaving for lunch, rest periods, or leaving the premises.

(2) Use of Protective Clothing. Protective clothing requirements shall be specified by supervisor for all operations involving radioactive material. Contaminated clothing shall be removed at point of egress from contaminated area.

(3) Zone Control. The movement of personnel and equipment from contaminated to clean areas shall be controlled or placed under stated restrictions.

(4) Storing and Handling Radioactive Materials. Operations with radioactive solutions in quantities in excess of those listed in Appendix C, Reference 2, shall be conducted in a tray or basin of sufficient capacity to hold all the solution if spilled.

Solutions shall be in containers unlikely to be broken or to spill. For high activity levels, the container shall have a secondary container or catchment under or around it. Caution shall be exercised in handling radioactive liquids in the laboratory. Work areas (bench tops, hoods, etc.) must be covered with absorbent material. Liquid samples carried between rooms must be in closed, non-breakable containers or else in a container surrounded by a secondary non-breakable container with absorbent material sufficient to take up the entire sample if spilled.

Samples for counting shall not be carried to the counting room in hands or instruments that have not been monitored and proven free of loose contamination. Samples must be carried in trays or the like to obviate getting any on the floor, etc.

Glassware known to be contaminated will be rinsed in the laboratory where it is used, to remove the major part of the activity. It will be segregated when sent to the glass washing shop for cleaning. Water used for washing and rinsing shall be regarded as contaminated waste and disposed of as such.

No radioactive material shall be transported via the escalators.

No contaminated materials shall be taken into machine shops or other service areas, unless specifically designated as an area for working with contaminated materials.

Movements of radioactive materials external to NRDL (e.g. over the State Highways) will be in compliance with California State regulations. A check should be made with the Health Physics Division to ensure that all items of compliance are met (see Section 3.1 E).

(5) Waste Disposal. All radioactive materials for disposal will be placed in waste containers provided. NEVER USE THE SINK. Waste solutions and solids containing alpha emitters will be placed in cartons and sealed with polyethylene before placement in containers. Special carboys will be used for organic liquids. Dead animals, which contain radioactive material, will be put into plastic bags, formaldehyde will be added, and the sealed bags placed in a 20 gallon can. (See Section 3.2 B.)

c. Special Precautions for Radiation and Contamination Control

Many of the Laboratory's radiation sources and particle accelerators produce levels of such magnitude that personnel exposed for even short periods of time might well receive serious radiation doses. Special safety systems and operating procedures are necessary to prevent inadvertent exposure. Such procedures shall be approved by the Division and Department Head concerned and forwarded to the Radiological Safety Committee for their review and recommendation.

(1) Radiating Machines. Flashing light and/or sound alarm systems which are automatically activated when the machines are turned on shall be installed on all radiating machines. Door interlock systems to prevent entry into the radiation field when the machine is in operation are mandatory. Special operating procedures shall be properly documented and posted to serve as an aid in preventing accidental exposure.

(2) Sealed Sources. All radiation sources greater than 1 curie shall be delineated with permanent type barriers. Warning signs will be posted and flashing light systems will operate when the source is exposed. Procedures shall be properly documented and posted to serve as an aid in preventing accidental exposure.

(3) Contaminated Areas and Equipment. The zone level of all work areas will be determined by the supervisor and suitable signs posted to indicate

the zone level and special precautions that are necessary. The Health Physics Division will mark work areas where more than 10 body burdens of radioactive material are handled with a sign indicating the approximate quantity and type of radioactive material present in the area. Zone 4 areas will be roped off or barricaded. Signs will be posted to indicate the radiation hazards present.

All contaminated equipment, including vehicles, will be tagged with contamination tags that clearly indicate the extent and location of the contamination. These tags will remain on the equipment until the Health Physics Division has determined that they are no longer required.

(4) Aerosols. If aerosol production is possible, or radioactive vapor or gas is involved, the material shall be transferred and operations carried out in a fume hood or if above RPC levels in a glove box. Heating of containers that hold radioactive material shall be done in a pan or tray to catch material, if spilled, and should be done in a fume hood even if material is considered non-volatile.

Table 4.4, Volume II, Reference (a) defines the requirements for respiratory protection in relation to the level of concentration of activity of airborne contamination.

(5) Control of Field Operation Samples and Equipment. The regulations for the control of movement and storage of Field Operation samples and equipment will be prepared by the Logistics Support and Health Physics Divisions and submitted to the Commanding Officer and Director via the Radiological Safety Committee for review and approval.

(6) Criticality Precautions. Special precautions are required to insure against the inadvertent accumulation of a sufficient quantity of special nuclear materials (U^{233}, U^{235}, Pu^{239} or other fissionable material) to create a critical mass with an attendant nuclear chain reaction.

Two types of configuration will be considered. The first will be unsealed quantities of special nuclear material. For the purposes of this manual, a "unit" will be defined as 250 grams of any unsealed special nuclear material.

Only one unit may be used in a room at any time. No quantities of unsealed special nuclear material greater than one gram may be used in rooms adjacent to a room where a unit is being used. In no event will the buffer distance be less than 12 feet. The Health Physics Division, Code 730, must be notified in advance before gram quantities of unsealed special nuclear material may be moved from any room. Gram quantities of special nuclear material not in use should be stored with the Health Physics Division.

The second type of configuration will be as "sealed sources" containing more than 250 grams of special nuclear material. The "sealed source" configuration must meet the criteria established in TID-7016, "Nuclear Safety Guide" for

Another method for monitoring tritium, which associates itself with the moisture in the air, is the "cold strip method". The method consists of a metallic strip immersed in a liquid nitrogen bath and extending well into the atmosphere to be sampled. Moisture condenses on the upper part of the cold strip. When the liquid nitrogen is completely exhausted, the ice melts and is collected in the Dewar flask. The specific activity of the tritium in aqueous sample is then calculated. The limit of detectability of this method is approximately 1×10^{-9} μc/cc.

(8) Plutonium. There are three main hazards to the use of plutonium. These hazards are criticality, pyrophoricity, and its high toxicity.

(a) Criticality. Criticality is the condition when fissionable material (i.e. U^{235}, U^{233}, Pu^{239}) is capable of sustaining a chain reaction. All of the deaths attributed to nuclear energy in the nuclear industry had been derived from an unplanned criticality. This is why criticality is such an important factor in the use of fissionable material.

(b) Pyrophoricity. Plutonium metal, especially in a finely divided state, is capable of spontaneous ignition. Plutonium hydrides and metallic alloys of plutonium are also pyrophoric. This property and an installed automatic fire smothering system should be considered, whenever gram quantity of solid plutonium is contemplated for use.

(c) Toxicity. Plutonium is one of the most hazardous radioactive elements known today. The long effective half-life and its alpha emissions had produced neoplastic growth in the bone tissue of lower animals. In man, the recommended permissible body burden for the bone is 0.04 μc, which is 2.5 times more restrictive than radium.

The easiest method of entry into the human body is via contaminated air. Proper design of the experimental apparatus and good housekeeping is the first step towards aerosol control. After the project had been initiated, air and surface monitoring should be performed regularly. All solutions of plutonium must be covered, when not in use.

Experiments regularly handling greater than one millicurie (16.2 mg) of plutonium should be done in a glove box. An enclosed system within the glove box should also be used as much as possible. It is imperative that no leakage of plutonium into the laboratory spaces be tolerated in Building 815. If the plutonium escapes into the laboratory and contaminates the ventilation system, the system will have to be shut down. This will necessitate evacuating the building until the system is decontaminated, which might run into months.

Another method of entry is via contaminated wounds or breaks in the skin. It is surprising the number of times one encounters reports of workers whose digits were punctured by plutonium chips or whose bare hands were in contact with high acidic solution of plutonium. Once the material is present in the subcutaneous tissue, the area will slowly but continuously release

sub-criticality by virtue of quantity, size, volume or dimension before procurement or use in the Laboratory. In addition, the basic configuration of the sealed source shall not be altered in any way during use and additional quantities of special nuclear materials shall not be used or stored in the same or in adjacent rooms.

(7) Tritium

(a) Precautions. Precautions to be taken when working with tritium or tritium-contaminated materials in quantities in excess of one millicurie include the wearing of rubber gloves and the use of glove boxes or hoods. Rubber gloves should be worn and changed frequently, since tritium water vapor passes through the rubber in hours or less. All equipment which has come in contact with tritium, either gas or T_2O vapor, will retain some tritium and should be considered contaminated. Stopcock grease, vacuum pump oil, and plastics are readily contaminated, whereas, materials such as glass or stainless steel retain smaller quantities. At ordinary room temperatures, the diffusion of tritium through glass or stainless steel or from tritiated accelerator targets is negligible. Tritium losses from targets may result from heating or by an exchange mechanism when in contact with ordinary hydrogen. Such targets must **always** be handled with rubber gloves, as quantities up to several curies per square centimeter of target surface may be absorbed on the target. Deuterium targets should also be handled with gloves, since tritium contamination of several microcuries may also be present.

Tritium contamination is so often associated with vacuum pumps that special precautions must be observed when disassembling or repairing a pump that has been used on a system containing tritium. Oil and mercury associated with the pumps should be carefully checked.

(b) Monitoring. All personnel working with tritium shall submit, periodically, urine samples for body uptake checks. Code 730 will advise the frequency of monitoring. All areas in which tritium is used in quantities in excess of one millicurie and especially vacuum pumps for systems containing tritium, should be monitored for absorbed surface tritium by health physics personnel. It must be remembered that the ordinary portable beta monitoring instrument will not detect tritium due to the very short beta particle range. Air monitoring instruments capable of detecting tritium are available and should be used when there is the possibility of release of tritium to the atmosphere.

Two instruments presently used to monitor radioactive gas are the T-289 and T-290 radiacs. These instruments measure the rate of ionization produced by radioactive gases in the surrounding air. Air drawn into the radiac passes through a precipitation chamber, which removes the free ions. The air then enters the ionization chamber which detects ions due to radioactive decay of gas. The limit of detection of the T-289 and T-290 is approximately 1×10^{-6} $\mu c/cc$ and 1×10^{-4} $\mu c/cc$, respectively.

plutonium into the blood stream, liver, and bone. Therefore, all opened cuts should be covered before work and any contact with plutonium should be followed by alpha monitoring and decontamination, if necessary.

In conclusion, the general health physics philosophy for the use of plutonium is the standard radiological safety practices, but only more stringent (i.e. always wear gloves, good contamination control, good housekeeping with no exposed sharp edges).

d. Precautions for Work after Regular Working Hours. The Health Physics Division and the Duty Officer are to be notified concerning any work with radioactive material after regular working hours. In any Zone 4 area, at least two people must be present, or observing from an adjoining area.

e. Controlled Maintenance Work. The Special Work Permit, 12ND NRDL-93, sets forth the controls necessary while maintenance or other work is being done by non-technical personnel. The purpose of the permit is to ensure that safeguards will be established and that radiologically safe working conditions will prevail. The following procedures apply:

(1) Requester. Any individual in the Laboratory who requests that maintenance work be done in an area where radiation or contamination hazards are suspected will make this known to the Plant Support Branch when submitting a request for accomplishment of the work.

(2) Plant Support Branch. Upon receipt of information that there is a possible contamination or radiation hazard involved, the Plant Support Branch will notify the Health Physics Division before the work is started.

(3) Health Physics Division. The proposed job will be appraised by a representative of the Health Physics Division and a Work Permit will be prepared and forwarded to the Plant Support Branch. A Health Physics Division representative will sign the Work Permit when it has been determined that the job has been satisfactorily completed from the rad-safe viewpoint.

(4) Maintenance Personnel. Protective clothing or tools, if such are required, will be picked up from the NRDL Clothing Issue Facility as indicated by the Special Work Permit. During the course of the work, maintenance personnel will follow instructions set forth in the Special Work Permit.

f. Decontamination

(1) Area Decontamination. Decontamination of a work area shall be done by personnel normally using the space or by Engineering Division Personnel, depending upon the effort required. Health Physics Division personnel will perform all necessary monitoring surveys, make recommendations on decontamination procedures and arrange for participation of Engineering Division personnel, as necessary.

(2) Equipment Decontamination. Equipment used in the Laboratory or on field operations may become contaminated to the extent that radiological controls are required before further use or storage. For uncontrolled use, it is mandatory that all equipment be decontaminated to final or standard clearance levels. Arrangements for equipment decontamination shall be made by the Health Physics Division in cooperation with the Engineering Division.

(3) Personnel Decontamination. There is no completely standardized system for skin decontamination. However, certain general methods have been fairly successful and these are incorporated in the procedure which is posted in each skin decontamination kit. These kits are available from the Health Physics Division. The Health Physics Division shall be contacted whenever personal contamination has not been completely removed by washing with soap and water.

Personal clothing that has become contaminated must be removed, then decontaminated. Replacement clothing will be issued from Laboratory protective clothing stocks on an emergency basis. In no case will contaminated clothing be worn away from the Laboratory. The Health Physics Division will be advised of all instances of personal contamination and will recommend corrective action.

2. Monitoring

a. Personnel Monitoring

The NRDL dosimetry program is conducted in accordance with regulations established by BuMed and the AEC for the protection of persons exposed to ionizing radiation in the course of their work. A complete record of all radiation doses received at the Laboratory or elsewhere shall be maintained for each person, using Form 12ND NRDL-79, Personnel Dosimetry Record. The completeness and validity of such a record is dependent upon the cooperation of each individual in wearing his badge properly during the work day and in reporting unusual circumstances or doses received outside of his regular employment.

(1) Radiation Received at NRDL. All persons who work at the Laboratory shall be monitored with one or more of the following types of dosimeters:

(a) Film Badges. A film sensitive to ionizing radiations is incorporated into the security and identification badge, and the issue and collection of these badges as a function of the Security Division. The processing, evaluation, and record keeping of the film in connection with the dosimetry program is a function of the Health Physics Division. All significant exposures will be investigated, whether or not maximum permissible limits have been exceeded.

(b) Pocket Dosimeters. Personnel working in Zone 4 areas are required to wear pocket dosimeters in conjunction with film badges. These

dosimeters are checked daily, and if a high reading is indicated, the film badge will be processed immediately to substantiate the chamber reading. Radiation as measured by pocket chambers will be used as a guide only and will not be incorporated in the permanent record.

(c) Individual Responsibility. Each individual employed in the Laboratory shall wear his identification film badge at all times while in the Laboratory. The badge shall be worn on the chest or collar. If a badge is inadvertently left in a radiation field, the individual shall retrieve it as soon as possible and must notify the Health Physics Division of the circumstances related to the exposure. Film badges must not be carried away from the SFBNS areas of NRDL, and employees are especially cautioned not to wear them when receiving medical X-ray or radioisotope diagnostic examination and/or treatment.

(d) Visitors. All visitors to NRDL facilities, including contractors and their employees, will wear film badges, except escorted visitors to Zone 1 areas of Building 815.

(2) Radiation Received Away from NRDL. Radiation doses received from outside the Laboratory shall also be included on each individual's record.

(a) Work at Other Activities. Each Branch Head shall notify the Health Physics Division when work involving radiation is to be done at other activities. If the dosimetry is accomplished by the other activity, the results will be returned to the NRDL Health Physics Division for inclusion in personnel dose records. If dosimetry is not available at the other activity, special film badges will be furnished and processed locally. (NOTE: NRDL film badges will be worn during work away from this activity only when prior arrangements have been made by the Health Physics Division.)

(b) Field Operations. Doses received by NRDL personnel at field operations will be officially reported by the Test Command to the Laboratory for inclusion in personnel records.

(3) Internal Contamination. The Radiological Health Officer will initiate all requests for radiochemical analyses, interpret results, recommend corrective action, and maintain personnel exposure records. The Health Physics Division will investigate positive results and aid in evaluation of findings. The total urinary output over 24 hours shall be collected and an analysis made for radioactivity.

(a) On each employee upon hire and upon termination.

(b) On any person known to have been exposed to ingestion, inhalation, or absorption of radioactive materials.

(c) Periodically, on personnel who routinely work with radioactive materials.

(d) On personnel engaged in field operations both prior to and upon return from the operation.

(4) Personal Contamination. In the event that any person is contaminated in excess of the lowest levels specified on page 16, the Health Physics Division shall be contacted immediately. A complete monitoring survey will be made to evaluate the extent of the contamination. Significant levels will be recorded on NRDL Form 12ND NRDL-342, Special Monitoring Report. The Health Physics Division representative will provide the necessary assistance to ensure complete decontamination. The degree of decontamination achieved and the final contamination levels will be recorded on the Special Monitoring Report. If the occasion warrants, an accident report shall be prepared as indicated in Section 1.5 A.

(5) Notification of Exposure

(a) Immediate notification of exposure in excess of the limits prescribed in Section 1.5 will be given the individual and his supervisor by Code 730.

(b) Information as to radiation exposure of an individual will be provided to the individual or his supervisor whenever requested.

(c) Following termination of employment at NRDL, the individual's radiation exposure record will be made available only upon his request.

b. Environmental Monitoring

(1) Routine Monitoring. A periodic monitoring program will be conducted at the discretion of the Health Physics Division. This includes, at various locations in the immediate geographic area, the measurement of radiation, liquid effluents being discharged to the public sewer system, and air effluents escaping from or being found outside the building. The Health Physics Division will recommend corrective measures for any contamination disclosed as a result of this program.

(2) Special Monitoring. Special monitoring surveys shall be made by the Health Physics Division and recorded as follows:

(a) Radiological clearance of equipment or areas.

(b) Contamination levels after decontamination operations.

(c) Radiation and contamination levels in connection with specific experiments.

(d) Special Work Permits.

(e) New equipment or building alterations that might change existing radiation contours.

Results of these surveys shall be reported on NRDL FORM 12ND NRDL-342, Special Monitoring Report, and permanent records will be made of all significant results. The Health Physics Division will evaluate the significance of any contamination and recommend corrective action.

3. Medical Examinations

The Radiological Health Division shall maintain a record of radiation dosage received by every person in the Laboratory. (Record of Exposure to Ionizing Radiation, Form DD-1141.) The records will be reviewed at regular intervals by the Radiological Health Officer to ensure that no one has received more than the MPD for a given period. The examinations and analyses shall be performed as indicated below.

a. Laboratory Operations

(1) Radiological Health Examinations. Upon reporting for work at the Laboratory, and upon termination of employment, each person will receive a radiological health examination in addition to the regularly required physical examination.

(2) Radiochemical Urinalysis. The Radiological Health Officer will obtain radiochemical urinalysis on the following:

(a) New Employees. A sample shall be obtained from each new employee at the time of his pre-employment physical examination.

(b) Termination of Employment. A sample shall be obtained from all employees upon termination. While such sampling shall be considered a part of the termination physical examination, it is preferred that it be submitted sufficiently prior to the last work day so as to permit analysis before the employee departs and for the results of analysis to be available to the examining physician at the time of termination of physical.

(c) Field Operations. Samples from NRDL personnel participating in field projects shall be submitted sufficiently prior to subject operation as to permit analysis before orders are issued. Field projects or any activity involving radioactive materials or radiation sources away from NRDL or Camp Parks. A post-operation sample shall be submitted upon completion of the field operation. Where possible, such sample will be collected at the test site at a time immediately following the last event in which the individual participated. Personnel not regularly assigned to field projects, who visit

test sites, shall be sampled in the same manner as full participants. Responsibility for all personnel reporting to NRDL Dispensary prior to departure for field projects and on return from field projects shall rest with the head of the department.

(d) Radiological Accidents. Each person, whether employed by NRDL or not, who is involved in a radiological accident on NRDL premises or at a NRDL administered field operation will, at the discretion of the Radiological Safety Officer or Health Physics Division and approval of the Radiological Health Officer, submit a sample immediately after such an occurrence. An accident is a spill or any contaminating event in which there is a possibility of assimilation of radioactive material in the body.

(e) Routine Sampling. Routine sampling, as ordered by the Radiological Health Officer, will be performed annually upon personnel using radioactive materials in pursuance of normal duties, and upon personnel working in spaces where such materials are used routinely. Tritium sampling shall be done weekly on all personnel using tritium in quantities in excess of the levels listed in Appendix C, Reference 2.

(f) Sampling for Activities Other Than NRDL. Requests for radioassay of biological samples received from other DOD activities will, upon approval by the Radiological Medical Director, NRDL, be processed in accordance with the procedures under Section 3 below. The Radiological Health Officer will prepare answering correspondence for the signature of the Radiological Medical Director.

(g) Follow-Up Sampling. Additional sampling will be accomplished, as required by the situation, at the discretion of the Radiological Health Officer as a recommendation by the Health Physics Division.

(h) Legal Release. When an individual declines to submit a properly requested specimen, he shall be required to sign a statement releasing the Laboratory and the Navy of legal responsibility.

(3) Special Examinations. The Radiological Health Officer will perform special examinations, as indicated below, upon the following:

(a) Any employee who developes an acute, unexplained illness of more than three days duration.

(b) Any person who has received an acute radiation exposure (from any source) in excess of 25 rem, or a chronic radiation exposure (from any source) of 75 rem if accumulated within a period of less than five years.

(c) Where a person is expected to be exposed to significant neutron or microwave radiations, a special eye examination shall be conducted prior to assignment of such duty, semiannually, and upon termination of employment.

b. Field Operations

(1) All Laboratory personnel participating in field operations will receive a physical examination, including a radiochemical urinalysis. Specific instructions will be issued prior to each operation by the Radiological Health Officer.

(2) If, during a field operation, any person is subjected to an exposure in excess of the established RPG, he will report to the Radiological Health Officer for a complete physical and clinical laboratory examination, including a radiochemical urinalysis, immediately upon termination of participation in the operation.

c. Visitors in Work Status

Medical surveillance may be required for certain visitors who may be subject to occupational exposure to radiation while within NRDL jurisdiction. Work status visitors may include military personnel from other installations, contractor personnel, students, or other persons performing work on an invitational, uncompensated basis.

Any individual working with radioactive materials within Laboratory premises or jurisdiction shall be required to undergo radiological health examinations as provided in Paragraph 3.a. of this manual. Also, any individual working four successive weeks or more in laboratory areas where exposure to ionizing radiation is possible (e.g. first, fourth, fifth, or sixth floors of Building 816 and 820, or certain areas of Camp Parks) shall undergo radiological health examinations.

The applicable division head (Code 908 for OCD contractors) will notify the Head, Radiological Health Division (Code 720), of those visitors who, as defined above, will require radiological health examinations. Such notification should precede the visit and should include the dates of the visit. The Medical Director, Code 700, will decide those cases in which doubt exists as to whether or not a given visitor will require radiological health examinations. The Camp Parks representative, Code 170, will assure through contact with the Medical Director, that Camp Parks visitors have received radiological health examinations where required.

4. Radiation Protection Guides (RPG's)

a. Definitions

(1) Radiation Protection Guide (RPG). The radiation dose which should not be exceeded; every effort should be made to encourage the maintenance of radiation doses as far below this guide as practicable.

(2) Radioactivity Concentration Guide (RCG). The concentration of radioactivity in the environment which is determined to result in whole body or organ doses equal to the Radiation Protection Guide.

b. Dose Limits

(1) General. Subject to exceptions in Paragraphs 2 and 3 below, the occupational whole body dose limit for Laboratory operations is 1.25 rems per calendar quarter.

(2) Special Operations. When required by the nature of the NRDL experiment, an individual may be permitted to receive a whole-body dose greater than 1.25 rems per calendar quarter provided: (a) the exposure shall not cause the individual to exceed 3.0 rems in the particular calendar quarter, (b) the exposure shall not cause the individual to exceed an accumulative lifetime dose equal to (N-18) x 5 rem (N being the individual's age); and (c) the operating supervisor previously ascertains that the individual has a documented exposure history on file with the Health Physics Division, Code 730.

(3) Minors. The dose limit for individuals under 18 years of age is 0.125 rems per calendar quarter.

c. Internal Contamination

The RCG's for radioisotopes entering the body from any process are listed in Volume 2, Appendix A, Part 1 of Reference (1) as MPBB's (maximum permissable body burdens). Body excretion rates resulting from MPBB's are listed in Volume 2, Table 4.5 of Reference (1). Laboratory operations will be conducted in such a way that internal contamination will be kept to a minimum.

d. Surface Contamination

The RCG's for surface contamination are listed as follows:

ISOTOPE	AVERAGE	MAXIMUM	REMOVABLE
Alpha Emitters	500 d/min-100 cm^2	1,000 d/min-100 cm^2	20 d/min-100 cm^2
Beta-Gamma Emitters	0.2 mrad/hr @ 1 cm	1.0 mrad/hr @ 1 cm	200 d/min-100 cm^{2*}

*For tritium, the removable limit is 10,000 d/min-100 cm^2

e. Air and Water Contamination

The RCG's for exposure of NRDL personnel to breathing air and drinking water are listed in Appendix B, Table I, Reference (2). The RCG's for air and water contamination for release from Laboratory control to the environment are listed in Appendix B, Table II, Reference (2).

5. Radiological Reports

Actions to be taken in emergencies are presented at the beginning of this instruction. In this connection the following reports are mandatory:

a. Accident Reports

(1) Preparation. Not later than 48 hours after the accident, the following will prepare and forward a written report, to the Chairman of the Radiological Safety Committee:

(a) The Head of the division involved in the accident. A report on the condition at the time of the accident, its probable cause, safety controls used, personnel involved, and degree of injury, if any, and immediate action taken. (Copies to Codes 905, 730, and 720.)

(b) The Head, Health Physics Division. A statement of the action taken by his group, analysis of the circumstances of the accident in order to determine error in procedure, and recommendations for prevention of similar accidents. (Copies to Codes 905, 720, and Division Head involved.)

(2) Review. The Radiological Safety Committee will study the reports, evaluate the hazards of such an accident, and recommend a course of preventive action. The Chairman, Radiological Safety Committee will attach the comments of the committee to each report and forward one copy of each to the Director and the Department Head concerned. Reports will be sent to distribution outside the Laboratory in accordance with instructions supplied by the Bureau of Medicine and Surgery and as set forth in the AEC authorization to NRDL to procure and handle by-product materials and special nuclear materials.

b. Radiological Overexposure Reports

Currently the permissible level for exposure to whole body radiation, as set forth in the Code of Federal Regulations, Title 10, Part 20, is 1.25 rem/quarter of penetrating radiation (deep dose) or 7.5 rem/quarter of non-penetrating radiation (surface dose). For the usual four week badging period, these levels would be 0.4 rem/4-week period and 2.5 rem/4-week period, respectively. Film badge exposures greater than these are considered to be in excess of that permitted for safe continued practice. Additional information on radiological exposure limits may be found in Section 1.5. Instances of overexposure as revealed by the film badge program will be investigated and reported in full particulars to the Radiological Safety Committee. The Committee will review the incident, determine the extent of the biological significance, and make recommendations for corrective action.

SECTION II

RADIOLOGICAL SAFETY EQUIPMENT

1. Protective Equipment

a. Clothing

Control of radioactive contamination requires the use of protective clothing to eliminate body contact with the contaminant and the spread of contamination to clean areas. Ordinary clothing provides some protection; however, the greater the body area covered, the larger the degree of protection achieved. Penetrability, durability, and ease of decontamination are important in the choice and use of protective clothing. The following items are available:

(1) Fine weave coveralls or laboratory coats for most laboratory operations.

(2) Gloves (surgeon's rubber, cotton, leather, or heavy rubber, depending on the job) to minimize hand contamination.

(3) Shoe covering (plastic booties, rubber boots, or rubber overshoes as required) where potential floor or ground contamination exists.

(4) Respiratory protection (such as Army Assault Mask or Navy Mark V mask) where there is danger of airborne contamination.

(5) Hoods (made of plastic or fine weave canvas) under appropriate conditions.

Protective clothing requirements for all operations in Zone 3 or 4 areas must be specified by the supervisor. The Health Physics Division representative assigned to each Division is available for advice on such matters.

b. Shielding Materials

The term "shielding materials" as used here includes all materials used to construct temporary shields or caves. Lead and concrete blocks are most commonly used in the Laboratory. Lead bricks are available in two-inch thicknesses of such size and shape to permit convenient handling and stacking in the formation of interlocked walls and caves.

c. Issue and Control

(1) Clothing. Issue of protective clothing originates with the individual who submits the appropriate request form, with the knowledge and approval of his supervisor to the Logistics Support Division at the NRDL Clothing Decontamination Facility. For most normal continuing type work done locally, the

NRDL Form 75, Protective Clothing Issue Card, are issued. For special work or one time situations, the Special Work Permit, NRDL Form 93, can be used for clothing issue.

(a) All items issued will be returned after use or for exchange to the NRDL Clothing Decontamination Facility, where they will be decontaminated or placed in stock as appropriate. Used items are monitored by Logistics Support Division under the technical supervision of the Health Physics Division. If contamination is found, it is reported to the Health Physics Division on NRDL Form 290, an investigation is made and corrective measures are recommended.

(2) Shielding Materials. One completed copy of NRDL Form 61, Request for Lead Bricks, will be forwarded to the Logistics Support Division via the Health Physics Division. The bricks will be delivered to the requester by the Logistics Support Division. When the bricks are no longer needed for protection against radioactive materials, the Health Physics Division will be notified and arrangements will be made for the bricks to be checked for contamination, decontaminated if necessary, and returned to stock.

(3) Control. The Health Physics Division will act as an advisory agent on the procurement, use, removal, and disposal of protective clothing, shielding materials, handling equipment and instruments.

2. Remote Handling Equipment

Work with radioactive material requires control and confinement of loose activity. For this purpose a stock of remote handling equipment, as listed below, is maintained at the Laboratory. It is the responsibility of the individual to requisition these facilities for the program in question. Health Physics Division personnel will advise on the procurement and use of the items as necessary. The following items are available for use at NRDL: (a) glove boxes, (b) enclosed work spaces or restricted rooms (Room 1109), Building 131 at Camp Parks are available for work with large quantities of radioactive materials, (c) temporary shielded areas constructed of lead bricks, concrete, etc., (d) tongs, and (e) master slave manipulators for use with very high levels of activity in hot cells.

3. Radiation Facilities

The Health Physics Division should be notified of the design features of any facility that is to be used for handling radioactive material. The prevention of personnel overexposures and aerosol releases during the course of any experiment can be accomplished through a review of the features of the facility by a Health Physicist.

Experimental facilities that are proposed for the use of radioactive material will be approved for adequacy of shielding, adequacy of aerosol control and adequacy of radioactive materials handling.

Proposed experimental plans that are submitted via NRDL Form 44 or 44A will be reviewed by the Health Physics Division for adequacy of structure to provide safe conduct of the experiment.

4. Monitoring Instruments

Monitoring instruments are essential tools in a radiological safety program. The variety of types and levels of radiation requires a wide range of instruments as to both model and quantity. There are a number of fixed installation instruments in the Laboratory (such as hand and shoe counters, continuous aerosol monitors, laboratory-type counters, etc.) as well as a supply of portable instruments.

Portable survey meters are divided into two general classes: contamination meters which are used to detect and estimate quantity of radioactive contamination, and dose rate meters which are used to measure radiation levels. A third class of instrument includes the counting and sampling devices. Portable instruments of all three types are available for use by the investigator and are maintained at the Central Instrument Pool for issue or replacement. Representatives from the Health Physics Division will aid and advise in the use of portable instruments as required.

5. Dosimetric Devices

Dosimetric devices include all types of instrumentation used to measure the accumulated radiation dose received by personnel. These are worn for stated intervals and then processed to determine accumulated radiation exposure. The doses are recorded and constitute the individual's legal dose record, upon which participation in and time limitations of future radiological work are based. Two types of personnel dosimeters are used at NRDL: film badges and pocket ionization chambers. Film is processed by the Health Physics Division, pocket chambers are issued by Code 243D upon recommendation of a health physicist, or as required in b below.

a. Film Badges

The NRDL badge is a plastic multifiltered film holder (with lead, aluminum, and cadmium shields) which contains a two-film packet (10 mrad to 10 rad and 8 rad to 1,000 rad). This badge is designed to serve also as a security badge and must be worn at all times by every Laboratory employee when in NRDL Buildings, even when in non-radiation areas. A separate film, also inserted into the plastic holder must be worn by all those personnel who work with neutron sources.

b. Pocket Ionization Chambers

Pocket chambers are used to supplement film badges in high exposure or short term work, since they provide an immediate indication of accumulated dose. While the chamber is used for dose control during a specific part of an

operation or experiment, the film badge is the final arbiter as to the amount of radiation actually received, and the film badge dose is entered upon the legal record.

Self-reading pocket dosimeters must be worn by all personnel who are present in a high radiation area (Zone 4).

SECTION III

ACQUISITION, CONTROL AND ACCOUNTABILITY OF RADIOACTIVE MATERIALS

1. Licensing Requirements

NRDL's AEC licenses provide certain limitations on the procurement, possession and use of radioisotopes. Some of these limitations are: (a) Radioisotopes may not be used in or on humans unless a specific license permitting that use is obtained. (b) NRDL is licensed to possess and use specific radioisotopes and quantities of these radioisotopes. Radioisotopes obtained in the regular procurement channels are screened for license compliance by the Health Physics Division. Any procurement outside the regular channels should be cleared with the Health Physics Division. (c) Radioisotopes may not be used at any location other than NRDL facilities except under limited conditions. Such proposed use should be cleared with the Health Physics Division. (d) Radioisotopes may not be transferred except to an activity licensed to receive the material.

2. Radioisotope Procurement

a. Determination of Requirements

A Scientific Investigator planning an experimental program involving the use of radioactive materials will determine the type and quantity of radioisotope or material required, the radiological safety equipment and the procedures necessary for safe conduct of the experiment. The Health Physics Division representative assigned to each division is available to assist and advise experimental investigators in the determination of requirements.

b. Request for Approval

The experimental investigator in the Scientific Department will submit the pertinent information on Radioisotope Use Approval Form, 12ND NRDL-44, prepared according to the instructions shown on the form, through his Divisional Office, to the Chairman, Radiological Safety Committee. The Associate Scientific Director will act as Division Head for investigators who are not members of the Scientific Department and are requesting radioactive materials for use at this Laboratory. Reorders or amended uses of isotopes for use in established experiments shall be initiated on Radioisotope Information Form 12ND NRDL-44A, a simplified version of the Form 12ND NRDL-44.

c. Radiological Safety Committee Review

The Use Approval Form 12ND NRDL-44, as prepared and submitted in b above, shall be reviewed by the Divisional Office, and forwarded to the Health Physics Division for review and a statement of the radiological safety requirements for the experiment shall be attached to the request on a Form 12ND NRDL-76, Health Physics Division, Isotope Procurement Investigation.

It will then be submitted to the Chairman, Radiological Safety Committee, who will review it and, if, in his opinion finds the radiological safety controls to be adequate, will authorize the use of the material as indicated on the form.

d. Ordering of Materials

After approval of the Radiological Safety Committee has been received:

(1) Using Division. (a) Will prepare the stub requisition (Request for Issue or Turn In, Form DD 1348-1, and special instructions or correspondence. All stubs will specify delivery via Code 730. (b) Will route all requests to Code 730, through normal channels.

(2) Health Physics Division. (a) Will review the request for conformance with safety and license requirements. (b) Will record necessary data to maintain the central record of all radioactive materials at the Laboratory. (c) Will initial or otherwise signify its review of Form DD 1348-1, detach copy for its records, and forward the request for processing through regular supply channels.

e. Receiving and Shipping

The Logistics Support Division shall receive all shipments of radioisotopes and shall deliver them to the Health Physics Division. Health Physics personnel will inspect the shipment, monitor the contents, and store the item until needed by the scientific investigator. Aliquots of materials may be withdrawn from the stores and delivered to the scientific investigators under the supervision of the Health Physics Division personnel.

Special attention shall be given to all orders involving shortlived isotopes (T-1/2 less than 24 hours). All stub requisitions for such material shall be specially marked by the Health Physics Division to assure prompt notification of the investigator upon arrival of the shipment.

The receipt of any radioactive isotipes or material specially irradiated, not involving the action of the Logistics Support Division, shall be handled directly by Health Physics Division personnel.

(All shipments of radioactive materials from the Laboratory will be made under the supervision of the Health Physics Division. Code 730 will make the necessary check to ensure compliance with the Interstate Commerce Commission, AEC, and all other regulations. Provisions of Tariff No. 8, Interstate Commerce Commission Regulations, Sections 73.391-4 and 73.414 apply.

3. Accountability and Control

The possession of radioisotopes, by-product material (radioisotopes with atomic numbers between 3 and 84, inclusive), and special nuclear materials

(those used in this Laboratory are hydrogen 3 (tritium), thorium 232, uranium 233, uranium 235, uranium 238, and plutonium 239) is controlled by licenses issued by the Division of Licensing and Regulation, AEC. The license requires the holder to maintain accurate inventories of materials and to conform to AEC regulations concerning disposal and transfer of the materials.

a. Accountability (physical)

Physical accountability for radioisotopes, by-product materials, and special nuclear materials is the responsibility of the Health Physics Division, which maintains complete records on location and use as required by the AEC. Radiation sources will be inspected and leak tested as required. Required reports to AEC will be the responsibility of the Health Physics Division.

b. Waste Control and Disposal

The quantities of radioactive isotopes and other nuclear materials used in the Laboratory necessitate a uniform procedure for handling and disposal (final accounting) of such materials when they become waste. Radioactive waste includes all materials that are contaminated to the extent that release through normal disposal channels would be inadvisable when public safety is considered. The procedures used for radioactive waste disposal are intended to guard against contamination of laboratory spaces, shipyard facilities, and the public domain as well as to permit utilization of radioisotopes. In the collection of waste special nuclear materials, the procedures to prevent criticality as outlined in Section 1, c. (6) above will apply. Specially marked waste containers will be used for all special nuclear materials.

Laboratory scientific investigators will anticipate waste disposal problems as far in advance as possible and advise Plant Support Branch, Engineering Division as to the need for additional waste containers. The Engineering Division will dispose of the radioactive waste material for the Laboratory with the Health Physics Division acting to ensure compliance with radiological safety regulations. The Health Physics Division will monitor Laboratory waste containers at regular intervals, tagging containers with special radioactive waste shall be approved by the Division and Department Heads concerned and forwarded to the Radiological Safety Committee for their review and recommendation.

SECTION IV

RADIOLOGICAL SAFETY ORGANIZATION

The Radiological Safety Program of the Laboratory is established with the advice of the following:

Radiological Medical Director
Health Physics Division
Radiological Health Division
Radiological Safety Committee

This Program is administered through the line of Command.

1. Radiological Medical Director

The Radiological Medical Director is responsible for the radiological safety of the Laboratory. Specifically, he performs the following functions: (a) Advises the Commanding Officer and Director on all matters of radiological safety. (b) Directs and coordinates the activities of the Radiological Health and Health Physics Divisions. (c) Reviews all instances of radiological exposure in excess of the maximum permissible limits and prepares reports of such exposures for submission to the Bureau of Medicine and Surgery.

2. Health Physics Division

The Health Physics Division is responsible for the overall operation and supervision of the Laboratory's radiological safety program. Operating within the Medical Department, the division serves the entire Laboratory. Specifically, the functions of the Division are to: (a) Formulate radiological safety regulations for review by the Radiological Safety Committee. (b) Implement the radiological safety regulations and procedures as promulgated by the Commanding Officer and Director. (c) Provide continuous monitoring and consultative services to project leaders and scientific investigators with regard to optimum conditions for safety in the use of radioactive material. (d) Maintain and provide personnel dosimetry for all Laboratory personnel and visitors. Interpret and report results obtained from these devices and maintain permanent dosimetry records. (e) Review all requests for isotopes and irradiation services so as to assure the Radiological Safety Committee that the proposals conform to licensing requirements. (f) Keep a central inventory of all radioactive material in the Laboratory and store safely what is not in immediate use. (g) Be ready to assist in the procurement of special nuclear materials. (h) Insure that the disposal of radioactive waste is safe and meets legal requirements. (i) Measure and record the radiation levels and concentration of liquid and airborne radioactive materials being discharged both within the Laboratory boundaries and in the environs. (j) Review and make recommendations on the rad-safe aspects of all new facilities involving radiation machines or radioactive materials.

In addition to the functions mentioned above, the Health Physics Division assists in training and indoctrination of personnel in radiological safety and performs evaluation and developmental work in the field of health physics, with special emphasis upon Laboratory problems.

3. Radiological Health Division

The Radiological Health Division is responsible for all medical aspects of the radiological safety program of the Laboratory, and for the physical welfare of the Laboratory personnel insofar as it relates to Laboratory working conditions. Specifically, this Division (a) conducts pre-employment and terminal physical examinations of all personnel, (b) performs radiological health examinations, as required, (c) conducts a radiobiological assay program, including radioassay of samples from other DOD activities, (d) acts as liaison between the Laboratory and the SFBNS Medical and Dental Departments, (e) controls all records relative to radiological exposure of personnel and the interpretations of them, and (f) compiles and interprets data from radioclinical laboratory analyses in cases of possible internal contamination with radioactive material and recommends appropriate action.

4. Radiological Safety Committee

The AEC stipulates that, to be eligible for a license to procure radioisotopes and to possess source and special nuclear materials, an institution must establish a Radioisotope Committee (CFR 10, Part 30). The Radiological Safety Committee serves in this capacity at NRDL.

The Radiological Safety Committee reviews requests for isotopes and special irradiation, certifies that procurement is necessary to program objectives, that the facilities are adequate to handle the materials, and that the proposed method of usage is in accordance with accepted safe practices. In addition, the Committee will review policies and procedures for radiation safety, cases of exposures in excess of the RPG, and radiological incidents and will make appropriate recommendations to the Commanding Officer and Director. In addition, the Committee, with the support of the Health Physics Division, takes the necessary action to obtain and maintain licenses for the procurement of radioisotopes and for the possession of source and special nuclear materials.

The Radiological Safety Committee is composed of the following:

Chairman - Associate Technical Director, (Applied Studies), Alternate Chairmen - Radiological Medical Director and Head, Health Physics Division, Members - Head, Biological and Medical Sciences Division; Head, Nuclear Technology Division, Head, Radiation Physics Division, Head, Physical Sciences Division, Head, Technical Management Officer, three addition members, two appointed from the Technical Department and one from the Technical and Administrative Services Department.

5. References

a. Principles of Radiation and Contamination Control, NAVSHIPS 250-343-3.

b. Code of Federal Regulations, Title 10, Part 20, "Standards for Protection Against Radiation".

c. Radiological Health Protection Manual, NAVMED P-5055.

1 June 1965

Telcon With Mr. Kibrassers -
Autovon - 21-831-1546 Ext. 240

1. Phone call with Lab. to inform them of Amend. #1 to SMB-376 License. "8. For use in accordance with the procedures described in the Lab's application dated 2 July 1964 & Supplement dated 17 May 1965."
2. #3 of AEC's ltr, 27 May 1965, should be noted. Lab's application refers to the use of respirators. Pursuant to 20.103(C)(1) of 10CFR20, copy enclosed, allowance may not be made for the use of protective eqpt. such as respirators in determining the exposure of individuals to concentrations of airborne radioactivity without specific Commission approval. An application for authorization to use such respiratory protective equipment should be submitted pursuant to Sec. 20.103(C)(3). This does not mean, however, that respirators may not be used to further reduce below the limits of 10CFR20, exposures of individuals to concentrations of radioactivity mtl. in restricted areas.
3. Al Smith at Conference - back in Lab. tomorrow afternoon. Should Al feel it desirable the Lab will submit app. for amend.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

11-243-65

IN REPLY REFER TO:
DML:KEL
40-5063
SMB-376, Amendment No. 1

MAY 27 1965

FROM: CHIEF, BUREAU OF SHIPS
TO: NRDL -
1. FORWARDED FOR YOUR RECORDS

SIGNATURE
Judd - 6-2-65

Chief, Bureau of Ships
Department of the Navy
Washington, D. C. 20360

Attention: Mr. M. G. Williams
Your reference: 10330/1
Ser 682C-520

Gentlemen:

Based on your letter dated May 17, 1965, Item 8 of Source Material License No. SMB-376, as renewed July 21, 1964, is hereby amended to read as follows:

"8. *For use in accordance with the procedures described in the Licensee's application dated July 2, 1964 and supplement dated May 17, 1965.*"

All other conditions of this license shall remain the same.

Your application dated July 2, 1964 refers to the use of respirators. Please note that pursuant to 20.103(c)(1) of 10 CFR 20, copy enclosed, allowance may not be made for the use of protective equipment such as respirators in determining the exposure of individuals to concentrations of airborne radioactivity without specific Commission approval. An application for authorization to use such respiratory protective equipment should be submitted pursuant to Section 20.103(c)(3). This does not mean, however, that respirators may not be used to further reduce below the limits of 10 CFR 20, exposures of individuals to concentrations of radioactive material in restricted areas.

FOR THE ATOMIC ENERGY COMMISSION

Robert L. Layfield
Robert L. Layfield
Source & Special Nuclear Materials Branch
Division of Materials Licensing

Enclosure:
As stated